

# The Sources of East Asian Economic Growth Revisited

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Lawrence J. Lau, Ph. D., D. Soc. Sc. (hon.)

Kwoh-Ting Li Professor of Economic Development

Department of Economics

Stanford University

Stanford, CA 94305-6072, U.S.A.

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Phone: 1-650-723-3708; Fax: 1-650-723-7145

Email: [ljlau@stanford.edu](mailto:ljlau@stanford.edu); Website: <http://www.stanford.edu/~ljlau>

# 1. The Sources of East Asian Economic Growth

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# East Asian Economic Growth

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- ◆ East Asia is the fastest-growing region in the world over the past two decades, the East Asian currency crisis of 1997-1998 notwithstanding
- ◆ East Asia has done exceptionally well despite relatively unfavorable resource endowment and population density. How has it been able to achieve this economic growth?

# Rates of Growth of Inputs & Outputs of the East Asian Developing & the G-7 Countries

**Table 3.1: Average Annual Rates of Growth of Real GDP, Capital, Labor and Human Capital (percent)**

(Extended sample period)

Country	Period	GDP	Capital Stock	Utilized Capital	Employment	Labor Hours	Human Capital	Average Human Capital
Hong Kong	66-95	7.4	8.8	8.6	2.6	2.4	4.8	2.1
S. Korea	60-95	8.5	12.3	12.3	3.1	3.3	6.2	4.0
Singapore	64-95	8.8	10.3	10.3	4.3	4.7	5.9	3.5
Taiwan	53-95	8.4	11.8	11.8	2.7	2.3	5.3	2.8
Indonesia	70-94	6.7	8.9	9.8	3.1	3.1	9.6	7.7
Malaysia	70-95	7.3	11.8	11.8	3.7	3.7	7.7	4.9
Philippines	66-95	4.0	5.8	5.9	3.2	3.2	10.8	8.5
Thailand	66-94	7.6	9.1	9.4	2.8	2.8	8.5	5.8
China	65-95	8.4	10.3	10.3	3.0	3.0	5.9	3.3
Japan	57-94	5.9	8.1	8.0	1.1	0.6	2.1	0.9
Canada	57-94	3.8	4.8	4.7	2.3	1.9	3.0	1.1
France	57-94	3.3	3.9	3.9	0.4	-0.2	2.0	1.1
W. Germany	57-94	3.2	3.3	3.1	0.1	-0.3	1.5	1.0
Italy	59-94	3.5	5.2	5.3	0.0	-0.3	1.8	1.3
UK	57-94	2.4	3.9	3.8	0.2	-0.1	1.2	0.8
US	49-94	3.1	3.0	3.3	1.7	1.3	2.1	0.8

# Accounting for Economic Growth

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- ◆ Decomposing the growth of output by its proximate sources
  - ◆ The growth of measured inputs: tangible capital and labor
  - ◆ Technical progress, aka growth in total factor productivity, aka “the residual” or “a measure of our ignorance”
- ◆ S. Kuznets (1966) observed that "the direct contribution of man-hours and capital accumulation would hardly account for more than a tenth of the rate of growth in per capita product--and probably less."  
(p. 81)
- ◆ M. Abramovitz (1956) and R. Solow (1957) similarly found that the growth of output cannot be adequately explained by the growth of inputs

# Accounting for Economic Growth

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- ◆ Denison (1962), under the assumption that the degree of returns to scale is 1.1, found less technical progress
- ◆ Griliches and Jorgenson (1966), Jorgenson, Gollop and Fraumeni (1987) and Jorgenson and his associates found even less technical progress by adjusting capital and labor inputs for quality improvements
- ◆ Boskin and Lau (1990), using labor-hours and constant-dollar capital stocks, found that technical progress has been the most important source of growth for the developed countries in the postwar period

# The Measurement of Technical Progress, aka the Growth of Total Factor Productivity

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- ◆ How much of the growth of output can be attributed to the growth of measured inputs? and
- ◆ How much of the growth of output can be attributed to technical progress, i.e. improvements in productive efficiency over time?
- ◆ **TECHNICAL PROGRESS (GROWTH IN TOTAL FACTOR PRODUCTIVITY) = GROWTH IN OUTPUT HOLDING ALL MEASURED INPUTS CONSTANT**

# Interpretation of Technical Progress (Growth of Total Factor Productivity)

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- ◆ Not “Manna from Heaven”
- ◆ Growth in unmeasured Intangible Capital (Human Capital, R&D Capital, Goodwill (Advertising and Market Development), Information System, Software, etc.)
- ◆ Growth in Other Omitted and Unmeasured Inputs (Land, Natural Resources, Water Resources, Environment, etc.)
- ◆ Improvements in Technical and Allocative Efficiency over time
- ◆ “Residual” or “Measure of Our Ignorance”



# The Point of Departure: The Concept of a Production Function

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◆ Definition:

- ◆ A production function is a rule which gives the quantity of output,  $Y$  , for a given quantity of input,  $X$  , denoted:

$$Y = F(X)$$

# The Economist's Concept of Technical Progress

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- ◆ A production function may change over time. Thus:

$$\text{◆ } Y = F( X, t )$$

- ◆ Definition:

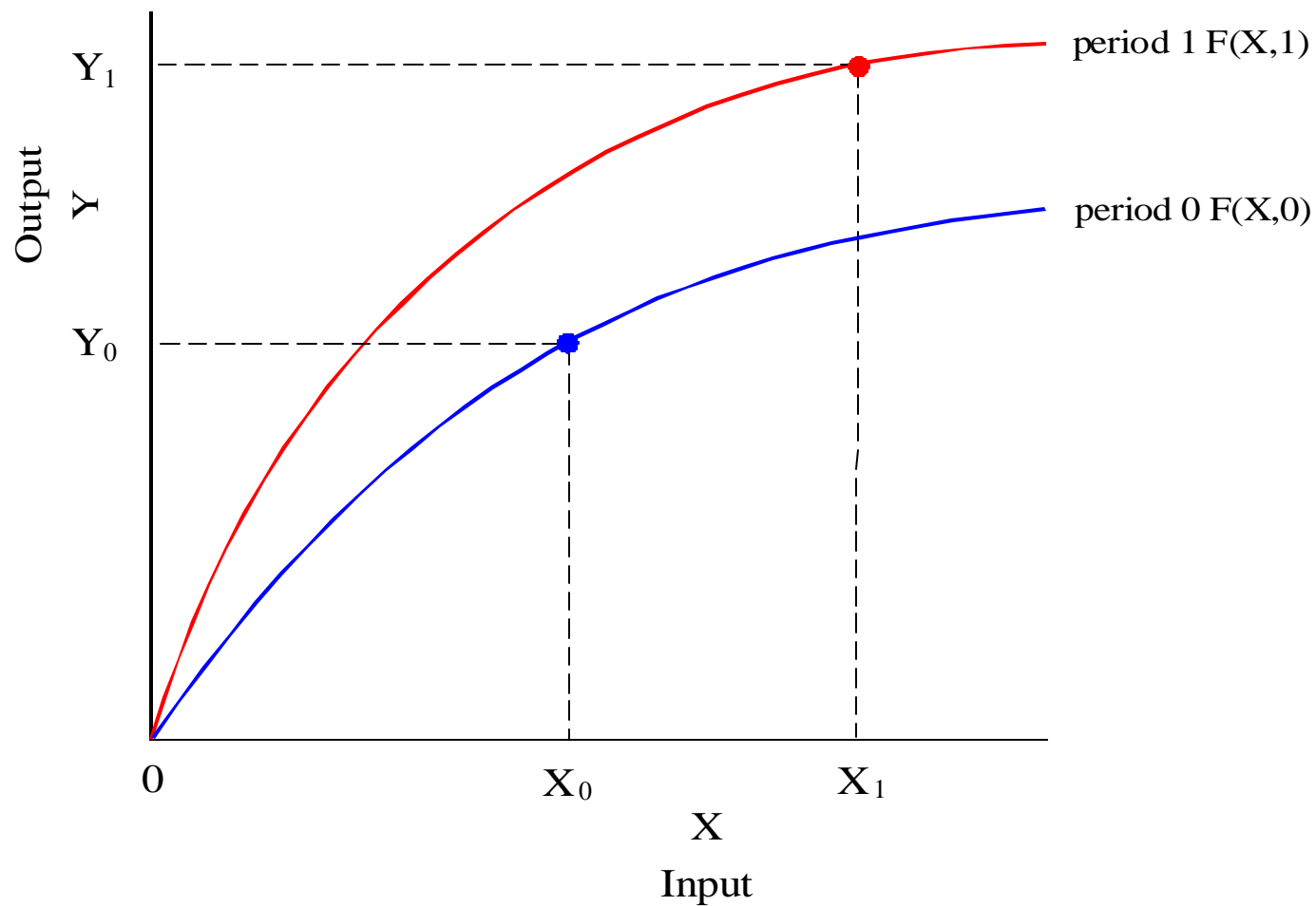
- ◆ There is technical progress between period 0 and period 1 if given the same quantity of input,  $X_0$ , the quantity of output in period 1,  $Y_1$ , is greater than the quantity of output in period 0,  $Y_0$ , i.e.,

$$F ( X_0, 1 ) \geq F ( X_0, 0 )$$

- ◆ TECHNICAL PROGRESS = THE GROWTH OF OUTPUT  
HOLDING MEASURED INPUTS CONSTANT

# Technical Progress: The Single-Output, Single-Input Case

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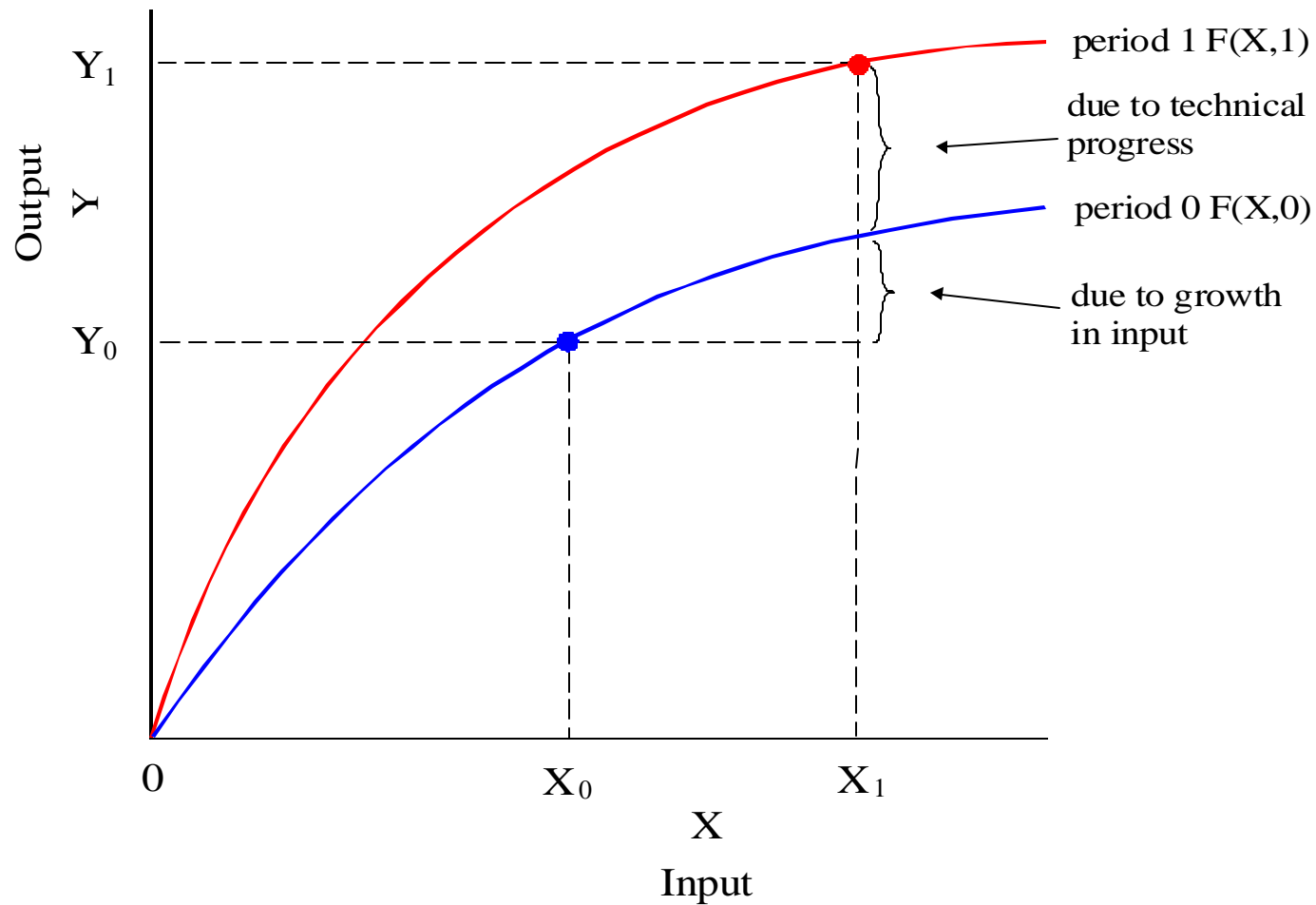


# Decomposition of the Growth of Output

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- ◆ If the production function is known, the growth of output can be decomposed into:
  - ◆ (1) The growth of output due to the growth of measured inputs (movement along a production function) and
  - ◆ (2) Technical progress (shift in the production function)
- ◆ The growth of output due to the growth of inputs can be further decomposed into the growth of output due to tangible capital, labor (and any other measured inputs)

# Decomposition of the Growth of Output



# The Findings of Kim & Lau (1992, 1994a, 1994b)

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- ◆ (1) No technical progress in the East Asian NIEs but significant technical progress in the IEs
- ◆ (2) East Asian economic growth input-driven, with tangible capital accumulation as the most important source of economic growth (the latter applying also to Japan)
  - ◆ Working harder as opposed to working smarter
- ◆ (3) Technical progress is the most important source of economic growth for the IEs, with the exception of Japan
  - ◆ NOTE THE UNIQUE POSITION OF JAPAN!
- ◆ (4) Technical progress is purely tangible capital-augmenting and hence complementary to tangible capital

# Capital-Augmenting Technical Progress

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$$\begin{aligned} Y &= A_0(t) F(A_K(t)K, A_L(t)L) \\ &= A_0 F(A_K(t)K, A_L L) \end{aligned}$$

# Accounts of Growth:

## Kim & Lau (1992, 1994a, 1994b)

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<b>Table 2.2: Relative Contributions of the Sources of</b>				
<b>Economic Growth (percent)</b>				
<b>Economy</b>	<b>Tangible</b>	<b>Labor</b>	<b>Technical</b>	
	<b>Capital</b>		<b>Progress</b>	
<b>Hong Kong</b>	<b>74</b>	<b>26</b>	<b>0</b>	
<b>Singapore</b>	<b>68</b>	<b>32</b>	<b>0</b>	
<b>S. Korea</b>	<b>80</b>	<b>20</b>	<b>0</b>	
<b>Taiwan</b>	<b>85</b>	<b>15</b>	<b>0</b>	
<b>Japan</b>	<b>56</b>	<b>5</b>	<b>39</b>	
<b>Non-Asian G-5</b>	<b>36</b>	<b>6</b>	<b>59</b>	



# The Sources of Economic Growth: Selected East Asian and Western Economies

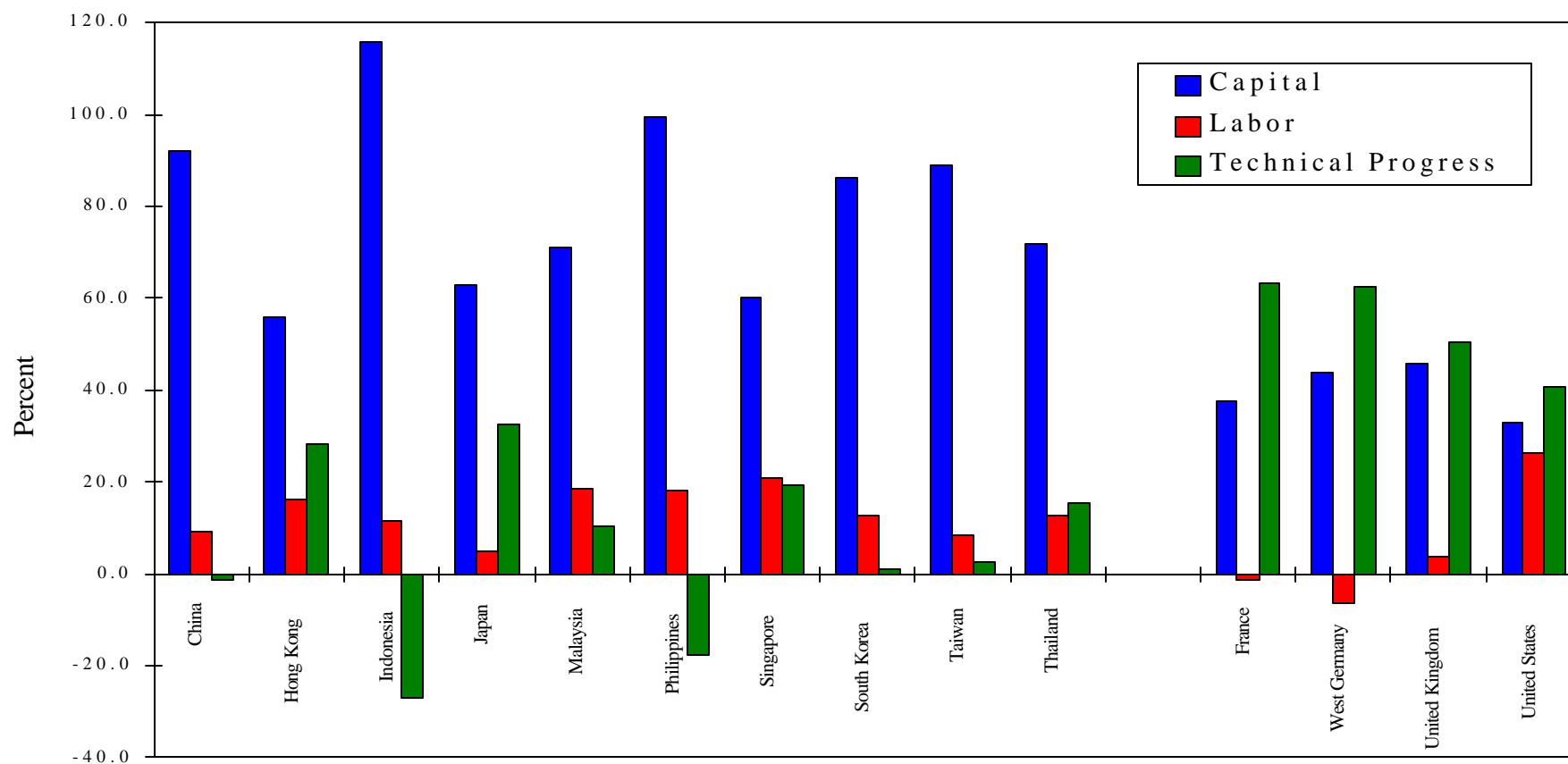
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The Contributions of the Sources of Growth (percent)

	Capital	Labor	Technical Progress
East Asian Economies			
China	92.2	9.2	-1.4
Hong Kong	55.8	16.0	28.2
Indonesia	115.7	11.5	-27.2
Japan	62.9	4.7	32.4
Malaysia	70.9	18.7	10.4
Philippines	99.5	18.0	-17.5
Singapore	60.0	20.9	19.1
South Korea	86.3	12.7	1.0
Taiwan	88.9	8.6	2.5
Thailand	71.9	12.7	15.4
Western Industrialized Economies			
France	37.8	-1.3	63.5
West Germany	43.7	-6.3	62.6
United Kingdom	46.0	3.7	50.3
United States	32.9	26.2	40.9

# The Sources of Economic Growth: Selected East Asian and Western Economies

The Contributions of the Sources of Economic Growth:  
Selected East Asian and Western Economies



# The Sources of Growth: Some Further Results

## Lau and Park (2000)

<b>Sample (G-5 + 4 NIEs)</b>			
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>74.46</b>	<b>25.54</b>	<b>0</b>
<b>South Korea</b>	<b>78.2</b>	<b>21.8</b>	<b>0</b>
<b>Singapore</b>	<b>64.8</b>	<b>35.2</b>	<b>0</b>
<b>Taiwan</b>	<b>84.04</b>	<b>15.96</b>	<b>0</b>
<b>Japan</b>	<b>49.9</b>	<b>4.84</b>	<b>45.26</b>
<b>Non-Asian G-5</b>	<b>38.71</b>	<b>2.77</b>	<b>58.52</b>
<b>Sample (G-5 + 9 Asian)</b>			
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>74.61</b>	<b>25.39</b>	<b>0</b>
<b>South Korea</b>	<b>82.95</b>	<b>17.05</b>	<b>0</b>
<b>Singapore</b>	<b>63.41</b>	<b>36.59</b>	<b>0</b>
<b>Taiwan</b>	<b>86.6</b>	<b>13.4</b>	<b>0</b>
<b>Indonesia</b>	<b>88.79</b>	<b>11.21</b>	<b>0</b>
<b>Malaysia</b>	<b>66.68</b>	<b>33.32</b>	<b>0</b>
<b>Philippines</b>	<b>66.1</b>	<b>33.9</b>	<b>0</b>
<b>Thailand</b>	<b>83.73</b>	<b>16.27</b>	<b>0</b>
<b>China</b>	<b>94.84</b>	<b>5.16</b>	<b>0</b>
<b>Japan</b>	<b>55.01</b>	<b>3.7</b>	<b>41.29</b>
<b>Non-Asian G-5</b>	<b>41.51</b>	<b>1.97</b>	<b>56.53</b>

# Why is There No Measured Technical Progress in East Asian NIEs? (1)

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- ◆ (1) Low level of investment in intangible capital (human capital, R&D capital, knowledge capital and other forms of intangible capital)
  - ◆ Utilization of other countries' intangible capital is not costless
  - ◆ Complementary indigenous investment is required, e.g., the Green Revolution
- ◆ (2) The distribution of "Innovation Rents" favors the innovators and investors
  - ◆ Fully priced capital goods and technology
  - ◆ Monopolistic pricing of capital equipment, technology licenses and critical components
  - ◆ Transfer pricing by foreign direct investors
  - ◆ Limited value added, e.g., notebook computers
  - ◆ Monopsonistic pricing for OEM manufacturers

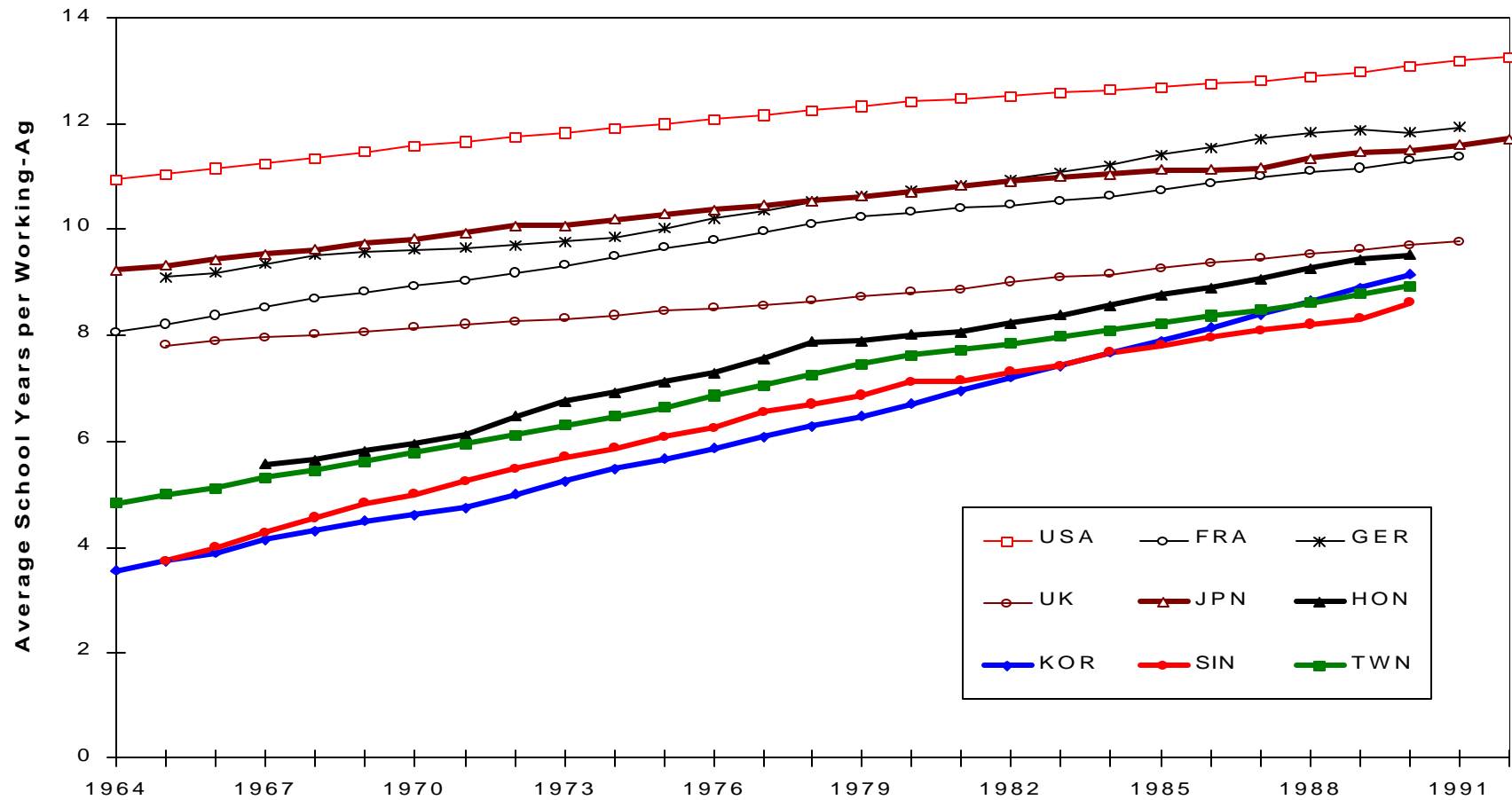
# Why is There No Measured Technical Progress in East Asian NIEs? (2)

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- ◆ (3) Problems of Measurement of Capital
- ◆ (4) Aggregation
- ◆ (5) Omission of the value of the quality of life

# Human Capital

Figure 3.1 Human Capital



# Sources of Economic Growth with Explicit Inclusion of Human Capital

**Table 2.3: Relative Contributions of the Sources of Economic Growth (percent)**

			Intangible Capital			
	Tangible	Labor	Human	R&D	Technical	Total
	Capital		Capital	Capital	Progress	
<b>Hong Kong</b>	<b>66</b>	<b>22</b>	<b>11</b>	<b>NA</b>	<b>0</b>	<b>11</b>
<b>Singapore</b>	<b>63</b>	<b>25</b>	<b>13</b>	<b>NA</b>	<b>0</b>	<b>13</b>
<b>S. Korea</b>	<b>67</b>	<b>19</b>	<b>14</b>	<b>NA</b>	<b>0</b>	<b>14</b>
<b>Taiwan</b>	<b>75</b>	<b>14</b>	<b>11</b>	<b>NA</b>	<b>0</b>	<b>11</b>
<b>Japan</b>	<b>48</b>	<b>6</b>	<b>3</b>	<b>NA</b>	<b>43</b>	<b>46</b>
<b>Non-Asian G-5</b>	<b>32</b>	<b>7</b>	<b>5</b>	<b>NA</b>	<b>57</b>	<b>62</b>

# Human Capital: Some Further Results

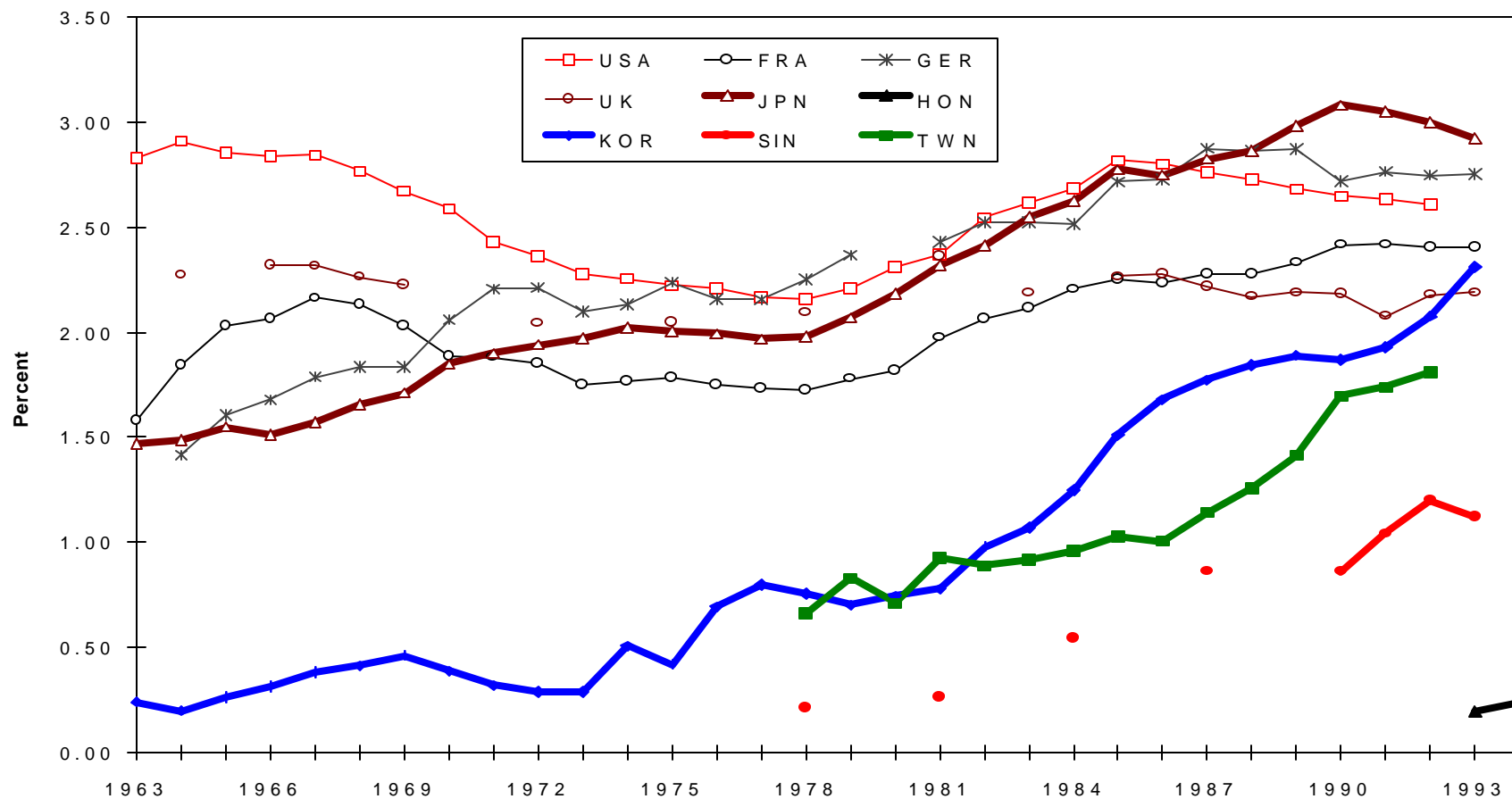
## Lau and Park (2000)

<b>Sample (G-5 + 4 NIEs)</b>				
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>62.85</b>	<b>31.38</b>	<b>5.77</b>	<b>0</b>
<b>South Korea</b>	<b>62.34</b>	<b>30</b>	<b>7.67</b>	<b>0</b>
<b>Singapore</b>	<b>56.5</b>	<b>36.36</b>	<b>7.14</b>	<b>0</b>
<b>Taiwan</b>	<b>70.16</b>	<b>23.37</b>	<b>6.47</b>	<b>0</b>
<b>Japan</b>	<b>40.01</b>	<b>8.77</b>	<b>1.81</b>	<b>49.4</b>
<b>Non-Asian G-5</b>	<b>31.15</b>	<b>6.22</b>	<b>2.92</b>	<b>59.71</b>
<b>Sample (G-5 + 9 Asian)</b>				
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>69.37</b>	<b>29.08</b>	<b>1.55</b>	<b>0</b>
<b>South Korea</b>	<b>75.44</b>	<b>22.33</b>	<b>2.23</b>	<b>0</b>
<b>Singapore</b>	<b>59.36</b>	<b>38.82</b>	<b>1.82</b>	<b>0</b>
<b>Taiwan</b>	<b>80.83</b>	<b>17.37</b>	<b>1.8</b>	<b>0</b>
<b>Indonesia</b>	<b>77.49</b>	<b>17.36</b>	<b>5.15</b>	<b>0</b>
<b>Malaysia</b>	<b>59.48</b>	<b>37.68</b>	<b>2.83</b>	<b>0</b>
<b>Philippines</b>	<b>54.6</b>	<b>41.24</b>	<b>4.16</b>	<b>0</b>
<b>Thailand</b>	<b>73.91</b>	<b>22.66</b>	<b>3.44</b>	<b>0</b>
<b>China</b>	<b>83.75</b>	<b>14.12</b>	<b>2.13</b>	<b>0</b>
<b>Japan</b>	<b>50.44</b>	<b>5.7</b>	<b>0.56</b>	<b>43.3</b>
<b>Non-Asian G-5</b>	<b>37.79</b>	<b>3.54</b>	<b>0.86</b>	<b>57.81</b>



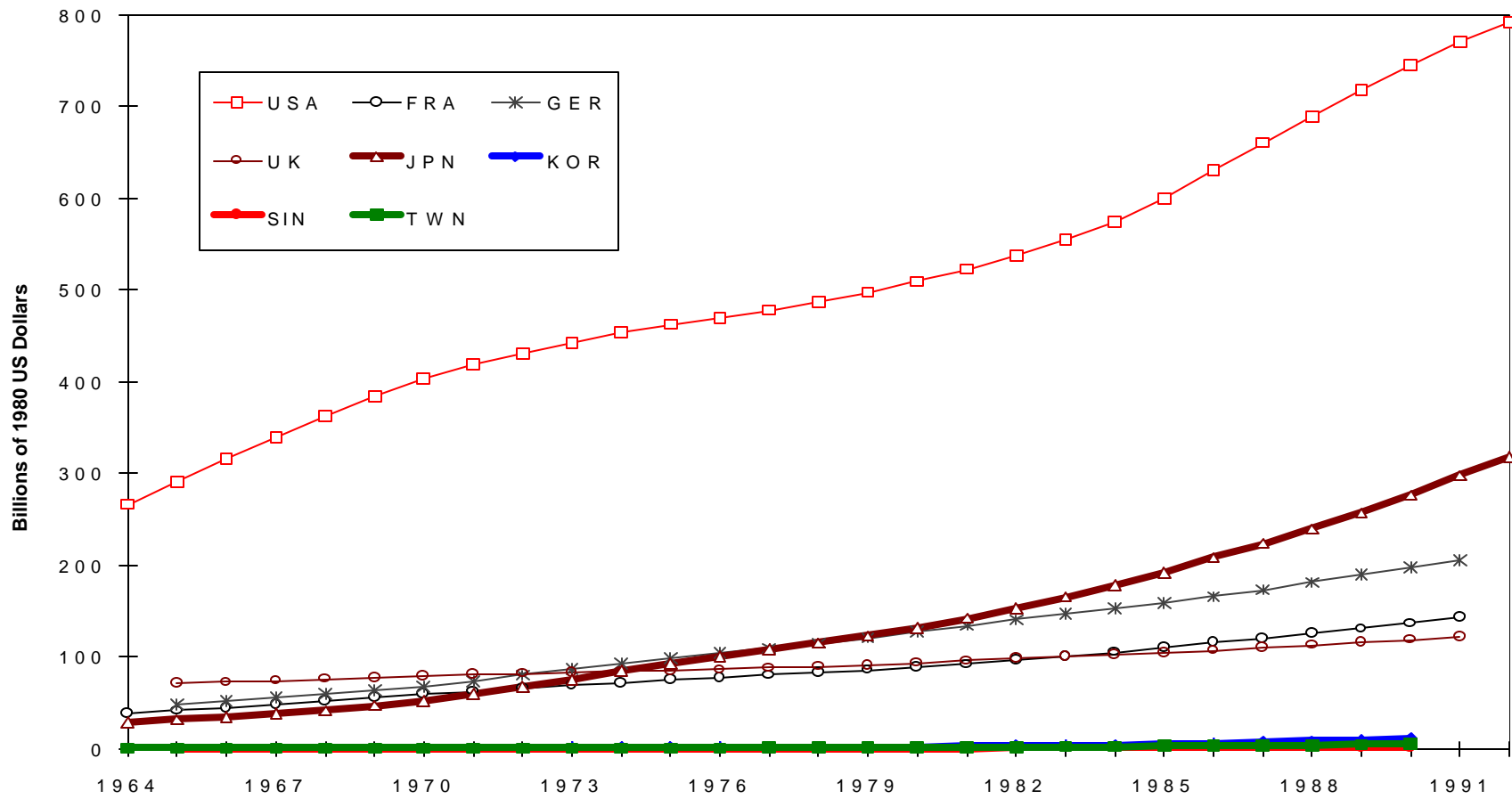
# R&D Expenditure as a Percentage of GDP

Percentage of Total R&D Expenditure in GDP (Current Prices)



# R&D Capital

Figure 3.2 R&D Capital



# Sources of Economic Growth with Explicit Inclusion of Human and R&D Capital

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<b>Table 2.4: Relative Contributions of the Sources of Economic Growth (percent)</b>						
			<b>Intangible Capital</b>			
	<b>Tangible</b>	<b>Labor</b>	<b>Human</b>	<b>R&amp;D</b>	<b>Technical</b>	<b>Total</b>
	<b>Capital</b>		<b>Capital</b>	<b>Capital</b>	<b>Progress</b>	
<b>Korea</b>	<b>62</b>	<b>18</b>	<b>5</b>	<b>15</b>	<b>0</b>	<b>20</b>
<b>Singapore</b>	<b>56</b>	<b>22</b>	<b>5</b>	<b>16</b>	<b>0</b>	<b>21</b>
<b>Taiwan</b>	<b>65</b>	<b>15</b>	<b>4</b>	<b>16</b>	<b>0</b>	<b>20</b>
<b>Japan</b>	<b>37</b>	<b>5</b>	<b>1</b>	<b>8</b>	<b>49</b>	<b>58</b>
<b>Non-Asian G-7</b>	<b>40</b>	<b>4</b>	<b>4</b>	<b>10</b>	<b>43</b>	<b>56</b>

# Human and R&D Capital: Some Further Results (Lau and Park (2000))

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	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>R&amp;D Capital</b>	<b>Technical Progress</b>
<b>South Korea</b>	<b>63.35</b>	<b>13.61</b>	<b>2.1</b>	<b>20.94</b>	<b>0</b>
<b>Singapore</b>	<b>47.33</b>	<b>21.55</b>	<b>1.37</b>	<b>29.75</b>	<b>0</b>
<b>Taiwan</b>	<b>58.73</b>	<b>11.42</b>	<b>1.32</b>	<b>28.54</b>	<b>0</b>
<b>Japan</b>	<b>44.83</b>	<b>5.2</b>	<b>0.82</b>	<b>14.63</b>	<b>34.52</b>
<b>Non-Asian G-7</b>	<b>33.71</b>	<b>3.71</b>	<b>1.32</b>	<b>12.53</b>	<b>48.72</b>

# Sources of Economic Growth with Breaks in the Rates of Capital Augmentation (1985)

<b>Sample (G-5 + 4 NIEs)</b>				
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>48.41</b>	<b>27.57</b>	<b>8.16</b>	<b>15.86</b>
<b>South Korea</b>	<b>51.23</b>	<b>24.78</b>	<b>11.59</b>	<b>12.4</b>
<b>Singapore</b>	<b>46.73</b>	<b>32.43</b>	<b>10.86</b>	<b>9.99</b>
<b>Taiwan</b>	<b>58.26</b>	<b>21.61</b>	<b>9.87</b>	<b>10.27</b>
<b>Japan</b>	<b>38.89</b>	<b>9.17</b>	<b>3.24</b>	<b>48.7</b>
<b>Non-Asian G-5</b>	<b>30.13</b>	<b>7.09</b>	<b>5.21</b>	<b>57.57</b>
<b>Sample (G-5 + 9 Asian)</b>				
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>Technical Progress</b>
<b>Hong Kong</b>	<b>56.89</b>	<b>23.65</b>	<b>2.51</b>	<b>16.94</b>
<b>South Korea</b>	<b>65.45</b>	<b>18.62</b>	<b>3.84</b>	<b>12.08</b>
<b>Singapore</b>	<b>53.1</b>	<b>33.94</b>	<b>3.23</b>	<b>9.73</b>
<b>Taiwan</b>	<b>71.26</b>	<b>15.61</b>	<b>3.15</b>	<b>9.99</b>
<b>Indonesia</b>	<b>71.2</b>	<b>14.59</b>	<b>9.38</b>	<b>4.83</b>
<b>Malaysia</b>	<b>54.22</b>	<b>32.47</b>	<b>5.12</b>	<b>8.19</b>
<b>Philippines</b>	<b>54.05</b>	<b>37.81</b>	<b>8.15</b>	<b>-0.01</b>
<b>Thailand</b>	<b>60.84</b>	<b>18.06</b>	<b>5.65</b>	<b>15.44</b>
<b>China</b>	<b>83.87</b>	<b>11.92</b>	<b>4.21</b>	<b>0</b>
<b>Japan</b>	<b>49.04</b>	<b>5.23</b>	<b>1.08</b>	<b>44.65</b>
<b>Non-Asian G-5</b>	<b>37.44</b>	<b>3.36</b>	<b>1.7</b>	<b>57.49</b>

# Sources of Economic Growth with Breaks: Sub-periods

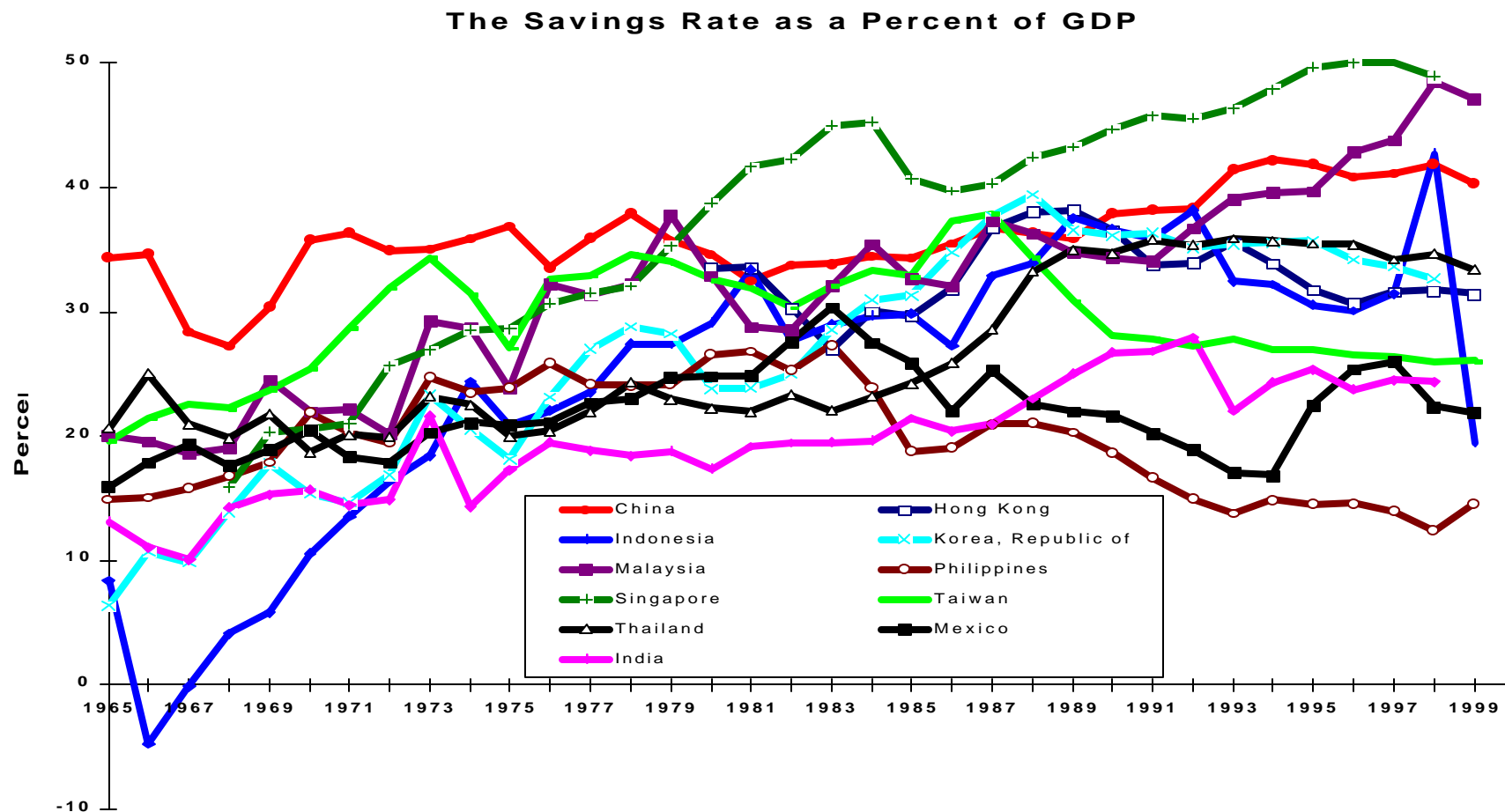
<b>Sample (G-5 + 9 Asian)</b>					
<b>1960s-1985</b>					
	<b>Tangible Capital</b>	<b>Labor</b>	<b>Human Capital</b>	<b>Technical Progress</b>	
<b>Hong Kong</b>	<b>65.34</b>	<b>31.65</b>	<b>3</b>	<b>0</b>	
<b>South Korea</b>	<b>74.66</b>	<b>20.58</b>	<b>4.76</b>	<b>0</b>	
<b>Singapore</b>	<b>60.09</b>	<b>35.97</b>	<b>3.94</b>	<b>0</b>	
<b>Taiwan</b>	<b>79.92</b>	<b>16.43</b>	<b>3.64</b>	<b>0</b>	
<b>Indonesia</b>	<b>76.44</b>	<b>12.41</b>	<b>11.15</b>	<b>0</b>	
<b>Malaysia</b>	<b>61.14</b>	<b>32.69</b>	<b>6.17</b>	<b>0</b>	
<b>Philippines</b>	<b>55.78</b>	<b>35.36</b>	<b>8.86</b>	<b>0</b>	
<b>Thailand</b>	<b>70.77</b>	<b>20.92</b>	<b>8.31</b>	<b>0</b>	
<b>China</b>	<b>83.05</b>	<b>12.36</b>	<b>4.59</b>	<b>0</b>	
<b>Japan</b>	<b>50.84</b>	<b>5.48</b>	<b>1.06</b>	<b>42.62</b>	
<b>Non-Asian G-5</b>	<b>39.69</b>	<b>0.88</b>	<b>1.71</b>	<b>57.72</b>	
<b>1986-1995</b>					
<b>Hong Kong</b>	<b>40.81</b>	<b>8.61</b>	<b>1.58</b>	<b>49</b>	
<b>South Korea</b>	<b>44.96</b>	<b>14.19</b>	<b>1.8</b>	<b>39.06</b>	
<b>Singapore</b>	<b>37.35</b>	<b>29.19</b>	<b>1.6</b>	<b>31.86</b>	
<b>Taiwan</b>	<b>41.45</b>	<b>12.61</b>	<b>1.4</b>	<b>44.53</b>	
<b>Indonesia</b>	<b>60.25</b>	<b>19.09</b>	<b>5.63</b>	<b>15.03</b>	
<b>Malaysia</b>	<b>43.3</b>	<b>32.04</b>	<b>3.44</b>	<b>21.22</b>	
<b>Philippines</b>	<b>49.71</b>	<b>44.03</b>	<b>6.29</b>	<b>-0.03</b>	
<b>Thailand</b>	<b>49.01</b>	<b>14.61</b>	<b>2.51</b>	<b>33.86</b>	
<b>China</b>	<b>85.75</b>	<b>10.9</b>	<b>3.35</b>	<b>0</b>	
<b>Japan</b>	<b>34.99</b>	<b>5.17</b>	<b>1.19</b>	<b>60.64</b>	
<b>Non-Asian G-5</b>	<b>27</b>	<b>14.66</b>	<b>1.63</b>	<b>56.72</b>	

# The Sources of Economic Growth--Developing Economies in East Asia

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- ◆ Different types of measured inputs play different roles at different stages of economic growth
- ◆ Tangible capital accumulation is the most important source of growth in the early stage of economic development
- ◆ But simply accumulating tangible capital is not enough--it must also be efficiently allocated
- ◆ Efficient tangible capital accumulation is the major accomplishment of the East Asian NIEs in the postwar period
  - ◆ Market-directed allocation of new investment, aided by export orientation, promotes efficiency
  - ◆ Private enterprises have the incentives for prompt self-correction
- ◆ Intangible capital accumulation becomes important only after a certain level of tangible capital per worker is achieved

# Savings Rates as a Percent of GDP of Selected East Asian Countries

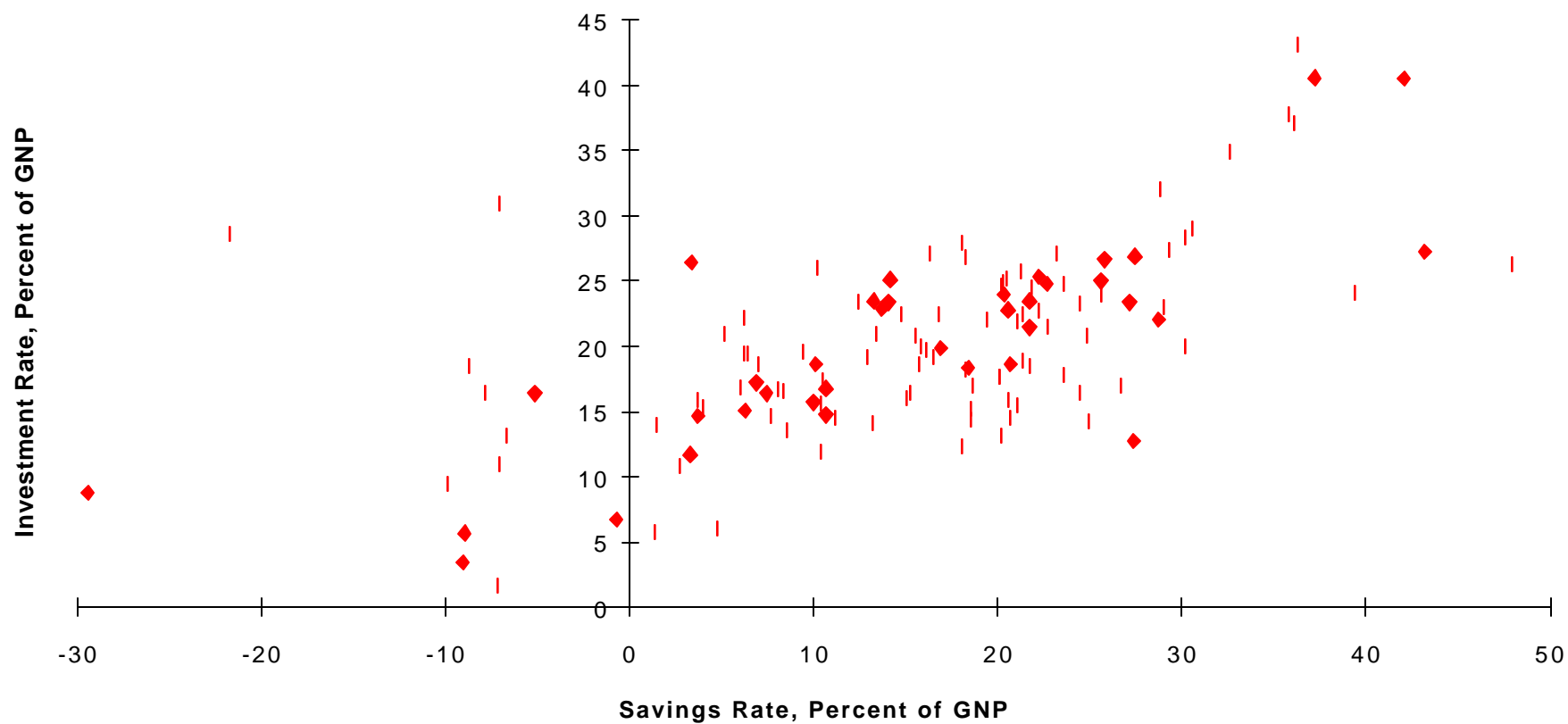




# The Relationship between Investment Rates and Savings Rates

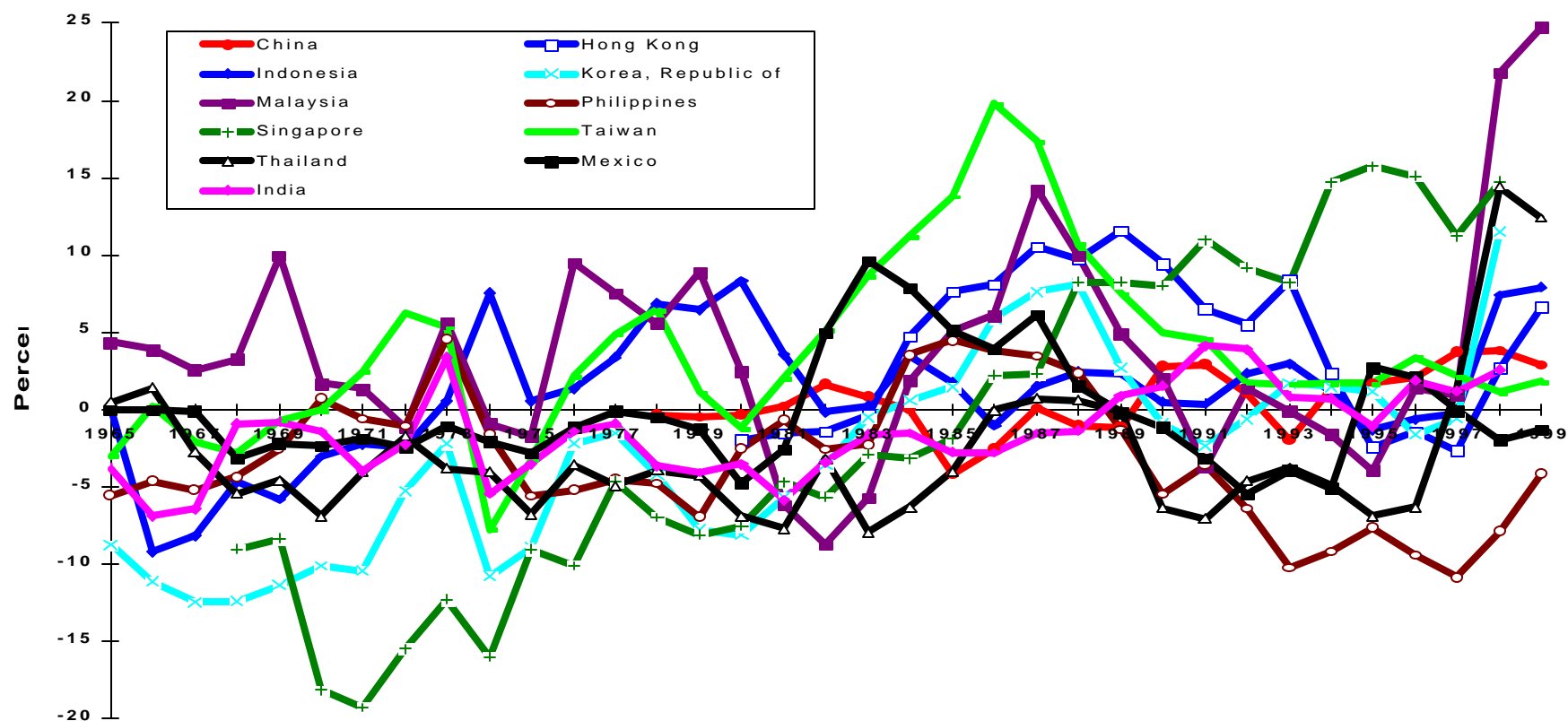
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The Relationship between Investment Rate and Savings Rate, 1995



# The Savings-Investment Gap as a Percent of GDP--Selected East Asian Countries

The Savings-Investment Gap as a Percent of GDP



# The Sources of Economic Growth-- Industrialized Countries

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- ◆ The most important source of economic growth for industrialized countries is technical progress, accounting for more than half of the growth of output
- ◆ Tangible capital is the next important source of economic growth, accounting for almost a third
- ◆ Technical progress reflects the effects of intangible capital--R&D capital, knowledge capital, goodwill, etc.
- ◆ The United States is a leader in human capital and R&D capital

# The Non-Uniqueness of the Postwar East Asian Experience

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- ◆ Abramovitz and David (1973): U. S. economic growth in the 19th Century can be largely attributed to the growth of inputs
- ◆ Tostlebee (1956): The growth in U.S. agriculture in the 19th Century can be attributed to the growth of inputs, with a negative rate of growth of total factor productivity
- ◆ Hayami and Ogasawara (1999): Japanese economic growth between the Meiji Restoration and the World War I can be largely attributed to the growth of inputs, principally capital
- ◆ Godo and Hayami (1999): Confirms the lack of technical progress in prewar Japan (with human capital included)

# The New Growth Theory

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- ◆ Technical progress due primarily to intangible investment (R&D capital, knowledge capital)
- ◆ The endogeneity of technical progress—innovation as a purposive economic activity (Romer, Grossman and Helpman)
- ◆ The increasing returns to knowledge capital—high fixed cost and low marginal cost
- ◆ Network externalities—the benefit of an innovation grows more than proportionally with the number of users
- ◆ Appropriability is important for the provision of incentives for continuous innovation (hence protection of intellectual property rights)

# Endogenous Technical Progress

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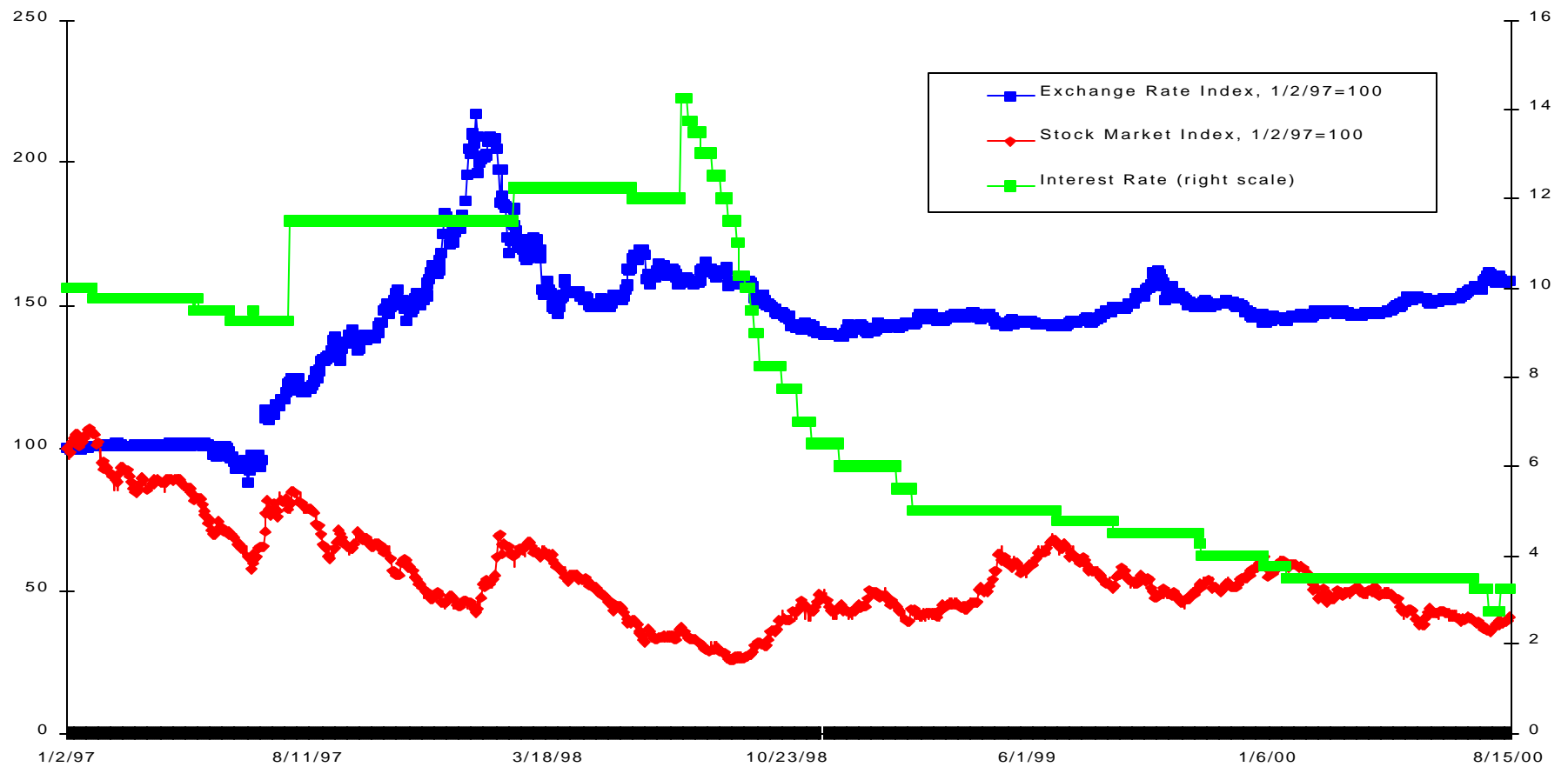
- ◆ Technical progress occurs through the expansion of the set of production possibilities (technical progress) so that a greater level of output can be produced with the same inputs
- ◆ The expansion of the production possibilities set is endogenous rather than exogenous—that is, innovation, especially commercially viable innovation, is motivated mostly by potential profits, and in particular, the possibility of monopoly rents
- ◆ The induced innovation hypothesis—innovation occurs wherever the profit potential (or cost reduction potential) is the largest
- ◆ The learning-by-doing hypothesis (Arrow)
- ◆ Complementarity between tangible and intangible capital (Boskin and Lau)
- ◆ Complementarity among the different forms of intangible capital (e.g., human capital, R&D capital, knowledge capital)

## 2.The Recovery from the Currency Crisis

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# Thailand

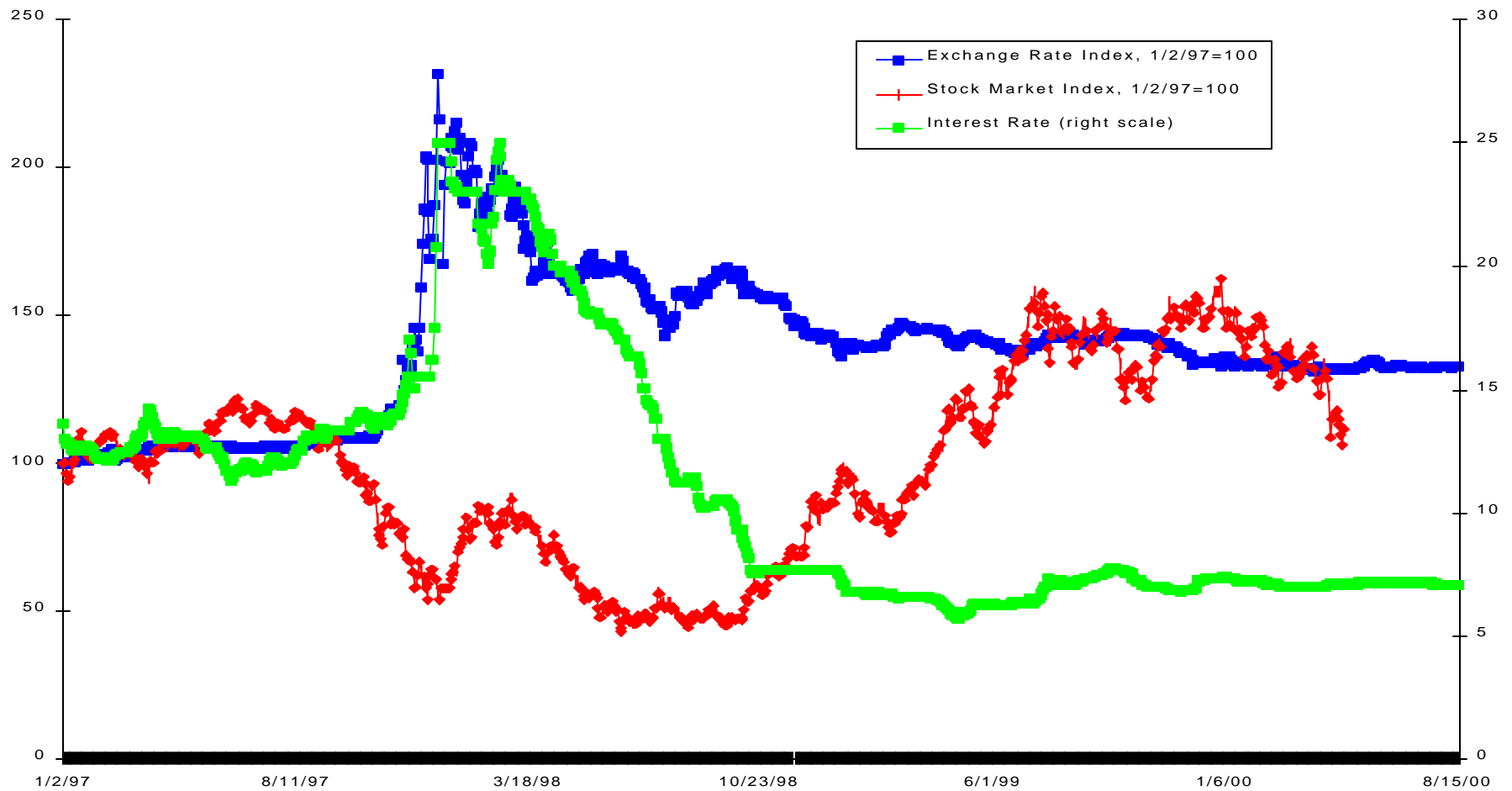
Relationship between Exchange Rate, Stock Market Index and Interest Rate, Thailand





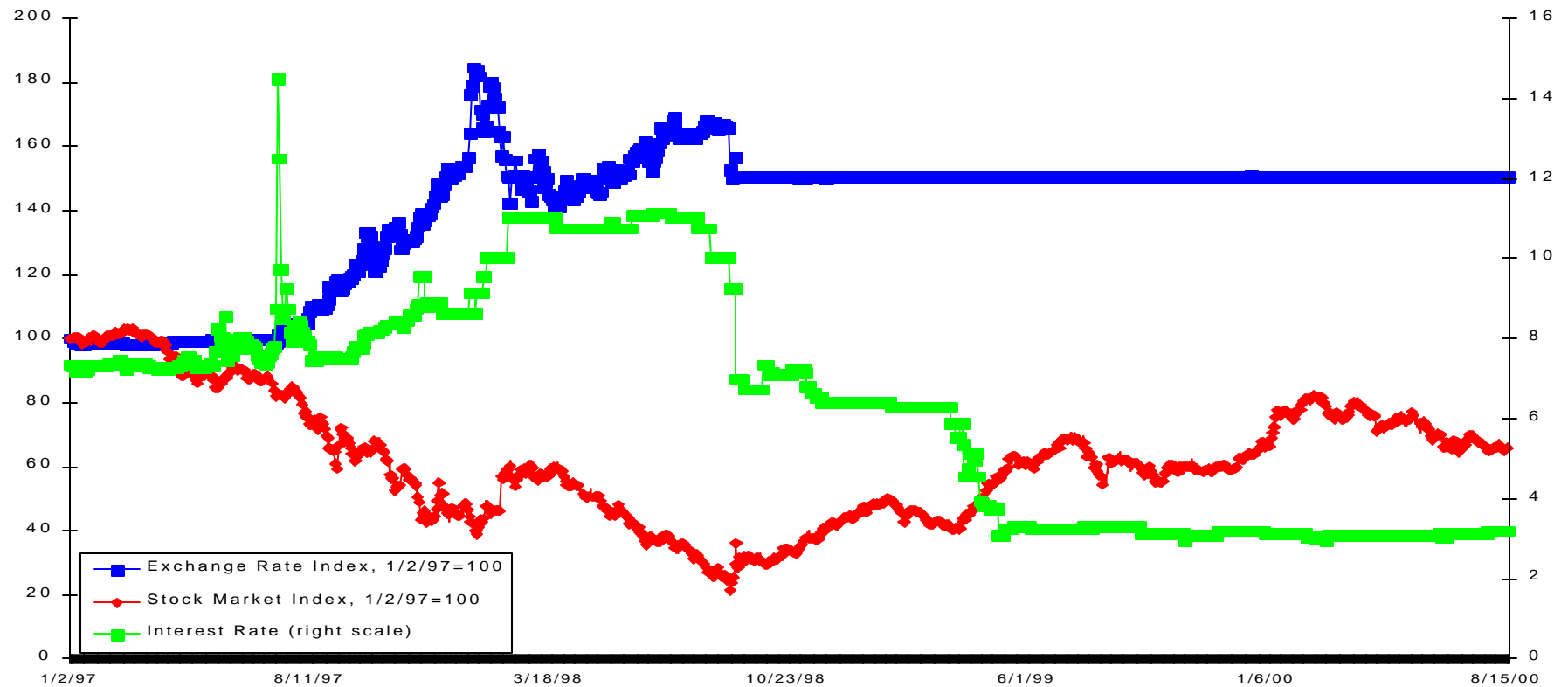
# South Korea

Relationship between Exchange Rate, Stock Market Index and Interest Rate,  
South Korea



# Malaysia

Relationship between Exchange Rate, Stock Market Index and Interest Rate, Malaysia



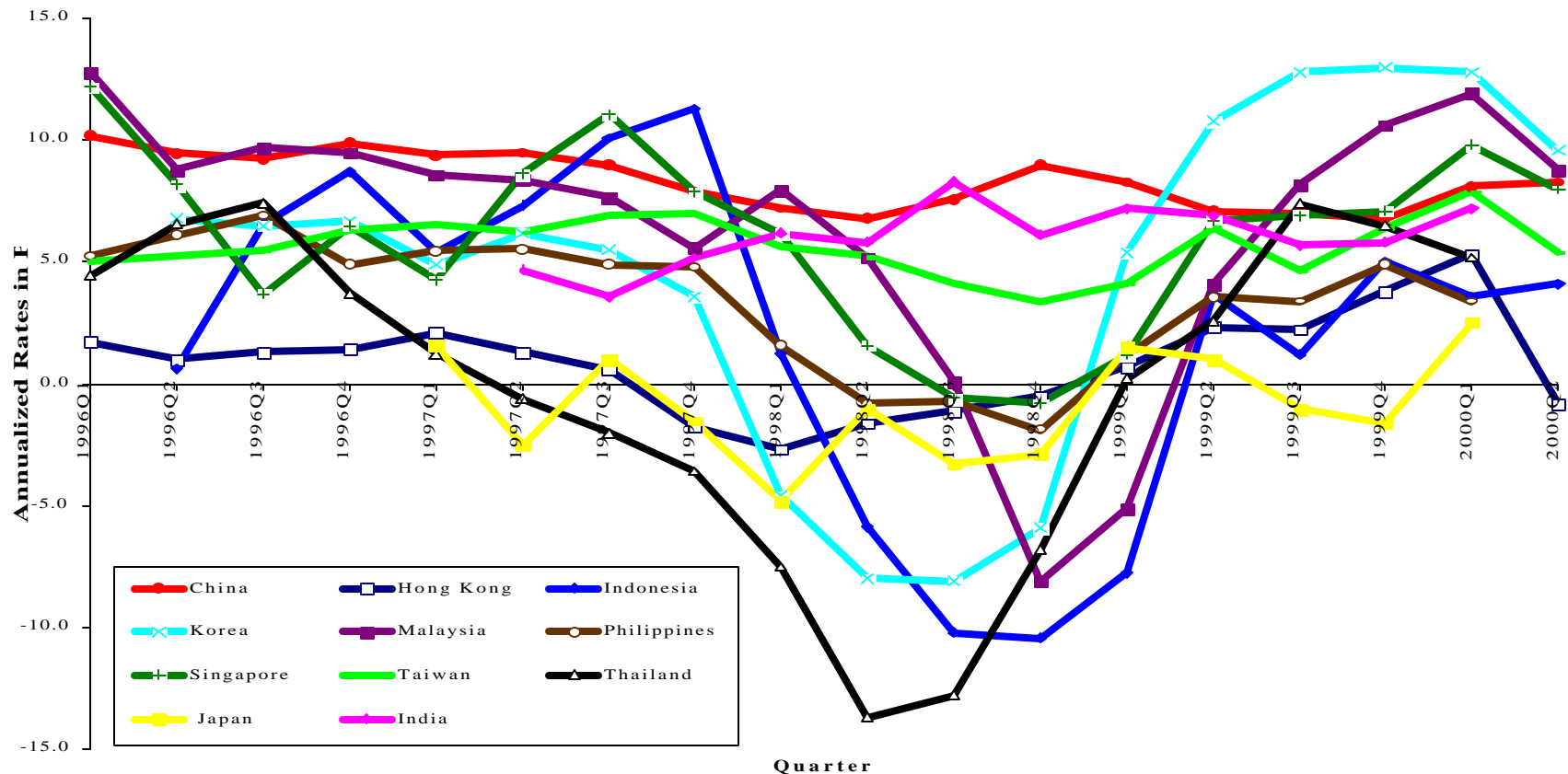
## Is the Recovery Real?

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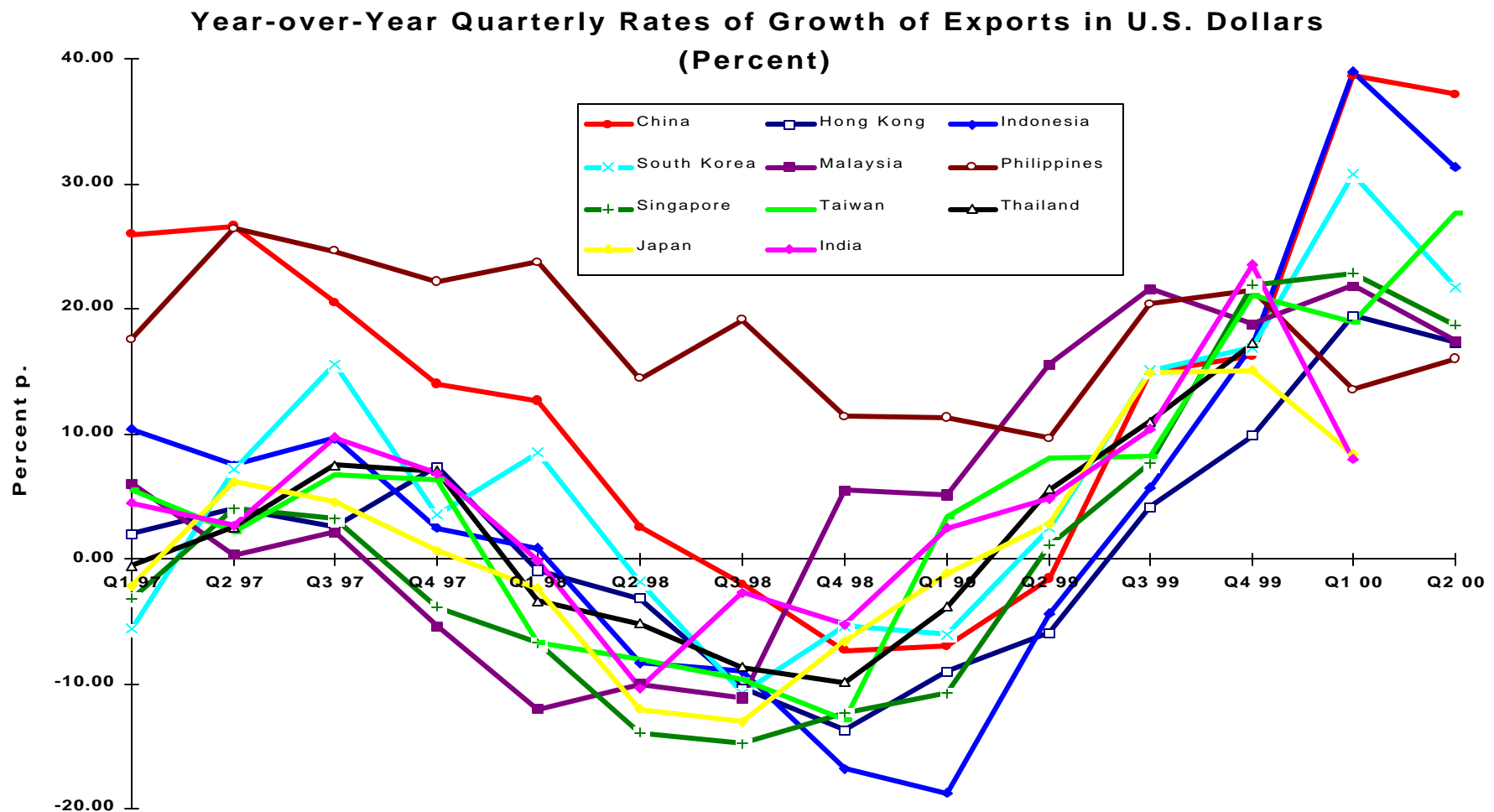
- ◆ For most of the East Asian economies, the bottom has been reached (0% rate of growth) in 2Q/1999
- ◆ The recovery is most tentative in Indonesia, with its political problems
- ◆ In quantity terms, exports have been growing very rapidly
- ◆ Foreign exchange reserves have been largely replenished
- ◆ Inflation caused by the devaluation has largely subsided
- ◆ The stock markets have rebounded
- ◆ The recovery has been much stronger than expected because of synchronization across the East Asian economies

# The Rates of Growth of Real GDP Have Turned Significantly Positive

Quarterly Rates of Growth of Real GDP, Year-over-Year, Selected East Asian Economies

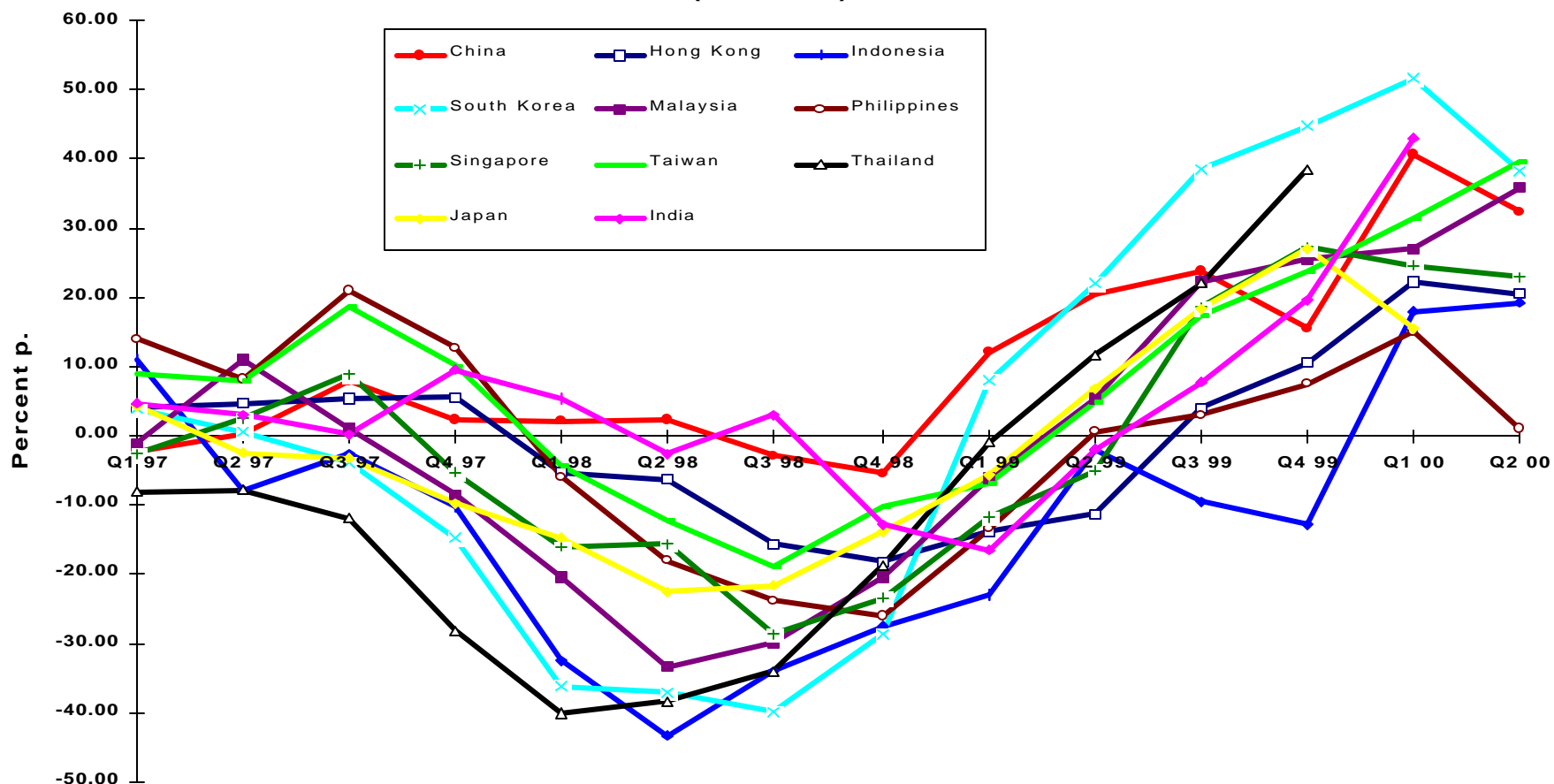


# Rates of Growth of Exports in US\$ Terms Have Turned Positive



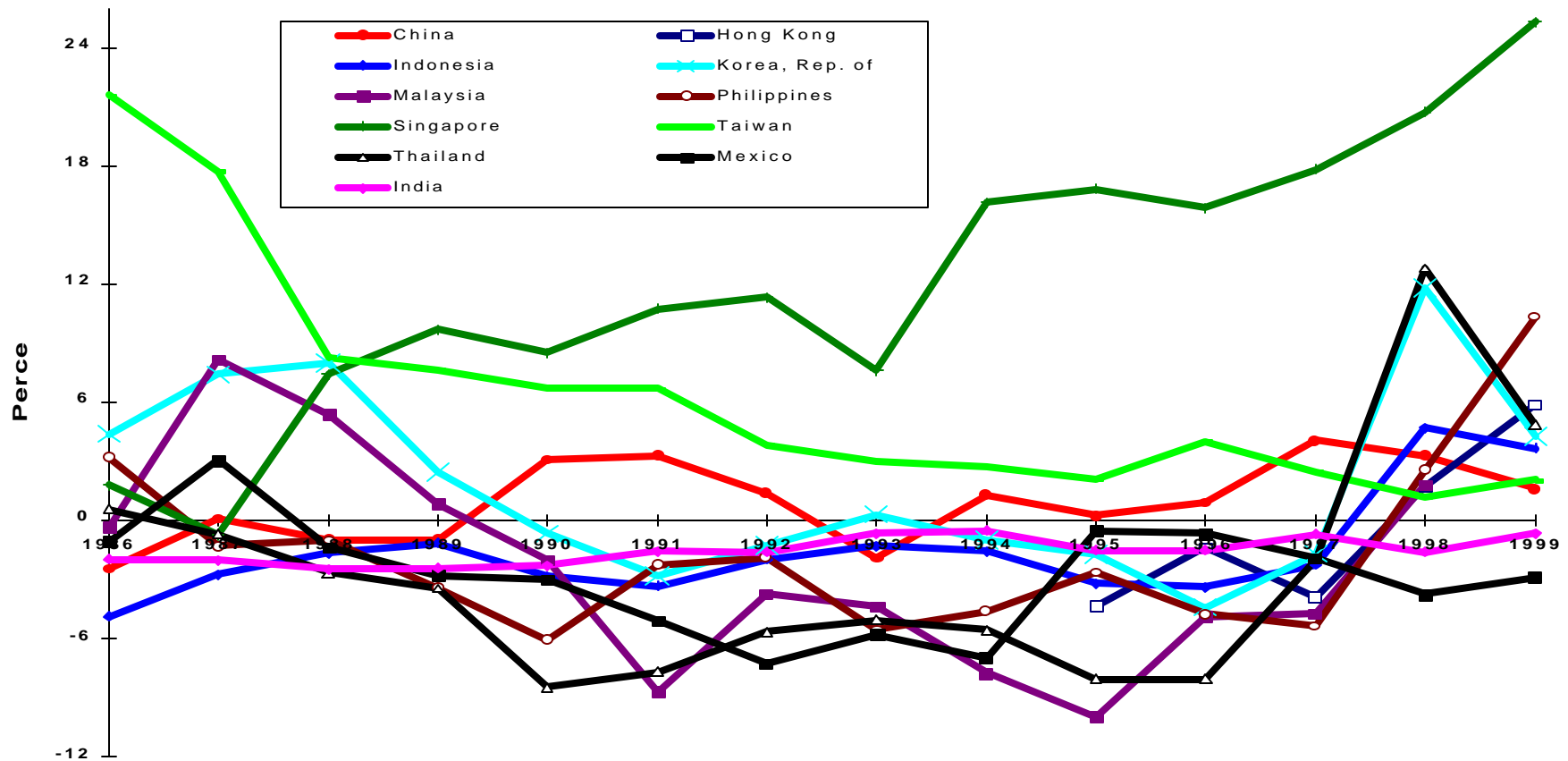
# Rates of Growth of Imports in US\$ Terms Have Also Turned Significantly Positive

Year-over-Year Quarterly Rates of Growth of Imports in U.S. Dollars  
(Percent)



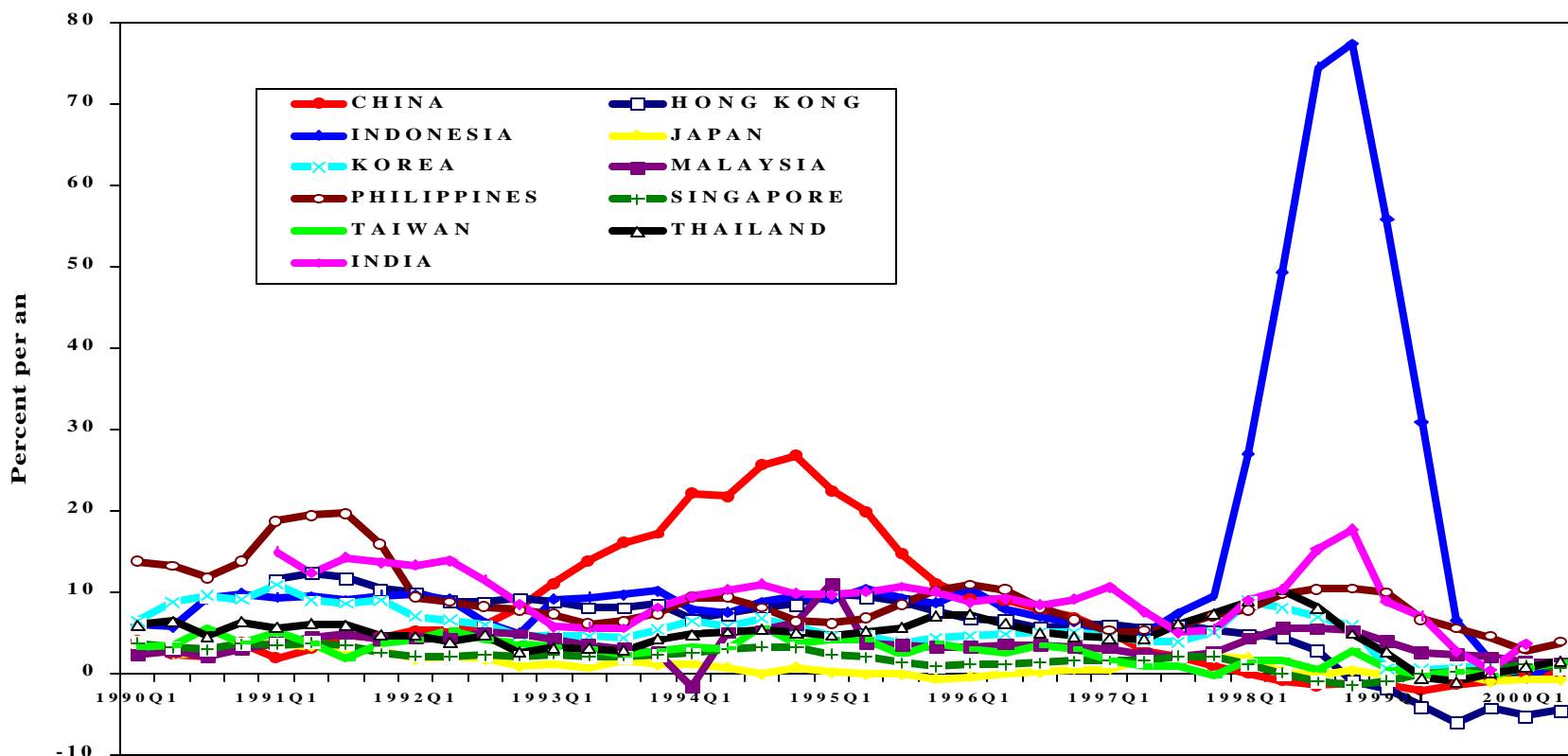
# The Current Account Balances Have Turned Positive

The Current Account Surplus (Deficit) as a Percent of GDP



# The Rates of Inflation (Consumer Price Indexes) Have Subsided

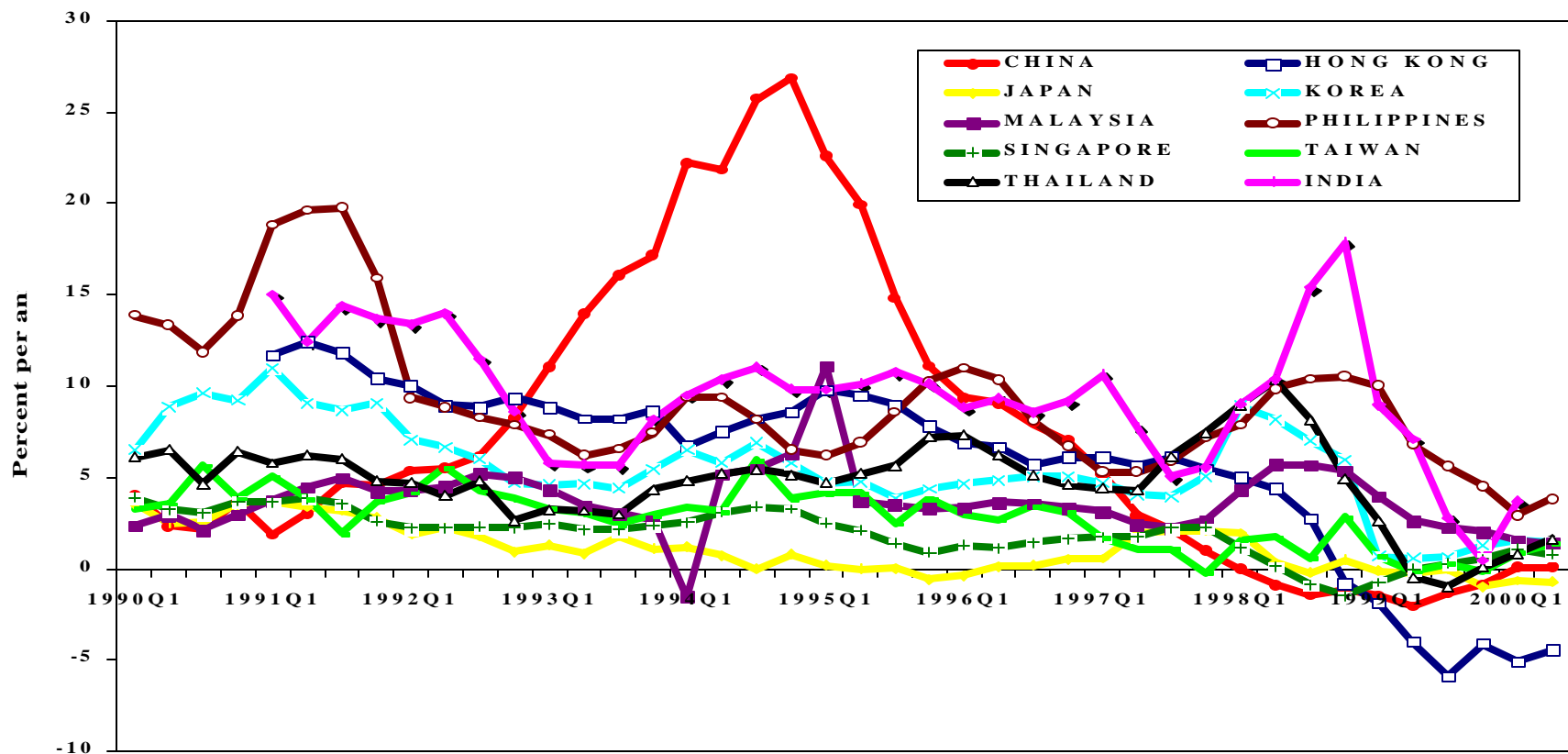
Rate of Change of the Consumer Price Index (Year-over-Year)





# Rates of Inflation (Consumer Price Index)-- without Indonesia

Rate of Change of the Consumer Price Index (Year-over-Year)



# How Robust is the Recovery?

## The External Environment Has Stabilized (1)

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- ◆ Since 3Q/1998, there have not been any speculative attacks on the Thai Baht or other East Asian currencies.
- ◆ The hedge funds had a “credit crunch” due to losses, net redemption and curtailment of available credit lines in the aftermath of the collapse of the Russian ruble and the “Long-Term Capital Management” crisis.
- ◆ The U.S. economy has been exceptionally strong but an asset-price bubble appears to be in the making and the economy may be heading towards a slowdown.
- ◆ The recovery of the Japanese economy is not imminent and likely to take some time; however, since it has been in recession since 1990, the East Asian recovery does not depend on an economic recovery in Japan. Moreover, the Yen has recovered from its low of almost 150 Yen/US\$ to stabilize around 110 Yen/US\$.

## The External Environment Has Stabilized (2)

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- ◆ The Chinese economy grew 7.8% in 1998, 7.1% in 1999, and 8.2% in the first half of 2000. Chinese exports have resumed its growth. The Renminbi should not need to be devalued.

# How Robust is the Recovery?

## Aggregate Demand Stimulation (1)

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- ◆ The recovery is supported by the growth in public investment and in exports
- ◆ Private consumption demand has gradually revived because of lower rates of interest and stabilization of the unemployment rates
- ◆ Domestic fiscal stimulus necessary because of weak domestic investment demand--International Monetary Fund conditions notwithstanding (IMF position on deficit financing by the affected East Asian countries has changed), e.g., South Korea, Thailand
- ◆ Turning around expectations and providing incentives are the keys to stimulating private consumption and new private investment
- ◆ The real devaluation in the East Asian currencies presents new opportunities for profitable investments once they are stabilized

## Aggregate Demand Stimulation (2)

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- ◆ Recapitalizing the domestic banks so that new loans to new projects are possible
  - ◆ Bailing out of old failed projects should be avoided
  - ◆ Recapitalization by the government should require capital contribution and risk-sharing by new or existing shareholders to avoid moral hazard
  - ◆ The political economy--who will bear the costs--may prove to be the most difficult problem
- ◆ Maintaining domestic political and social stability

# How Robust is the Recovery?

## Synchronization of Upturns

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- ◆ Over the last decade, the proportions of East Asian exports to other East Asian economies have been increasing rapidly
- ◆ By the late 1990s, approximately 50% of the exports of the East Asian economies are destined for other East Asian economies
- ◆ While the simultaneous downturns in the East Asian economies exacerbated the problems of one another, the simultaneous upturns have allowed the recovery to be extraordinarily rapid, with the rising import demands of each economy feeding into rising export demands of its trading partners

# Is Another Crisis Likely?

---

- ◆ Based on the early warning economic indicators, the East Asian economies are unlikely to have another crisis in the foreseeable future
  - ◆ The savings rates have remained high while the savings-investment gaps--also reflected as the current account gaps--have largely disappeared
  - ◆ The dependence on short-term foreign capital (portfolio investment--both equity and debt instruments--and loans) has been significantly reduced
    - ◆ Foreign investment now consists mostly of direct rather than portfolio investment
    - ◆ Both total and short-term external debts have declined
  - ◆ Foreign exchange reserves (working capital of a country) for supporting imports, debt service, and (potential) net short-term capital outflows have risen both absolutely and as a percentage of annual imports
  - ◆ Real exchange rates have depreciated significantly from their peaks in most of the affected economies

# The Major Uncertainties

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- ◆ The movements of the Yen-Dollar and Yuan-Dollar exchange rates
- ◆ The rates of growth of the U.S. and Japanese economies
- ◆ The U.S. rate of interest (one instrument, two targets--the prices of goods and the prices of assets)
- ◆ The possibility of a bursting of the U.S. asset prices bubble (Could the reliance on an accommodative easing by the Federal Reserve Board after such an event create its own moral hazard?)
- ◆ The return of the hedge funds (are bubbles building in the East Asian stock markets again?)



# Could the East Asian Currency Crisis be Averted?

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- ◆ The currency crises in some countries (e.g. Thailand and South Korea) probably could not be averted
- ◆ However, the severity of the crisis in certain countries could probably have been reduced if the exchange rate could have been stabilized sooner, that is, if the exchange rate had not overshoot by so much (most East Asian currencies had recovered approximately half of their losses at the troughs)
- ◆ Implicit are the assumptions that multiple self-fulfilling rational expectations equilibria are possible and that some such equilibria are better than others

## 3. Prospects for the Future

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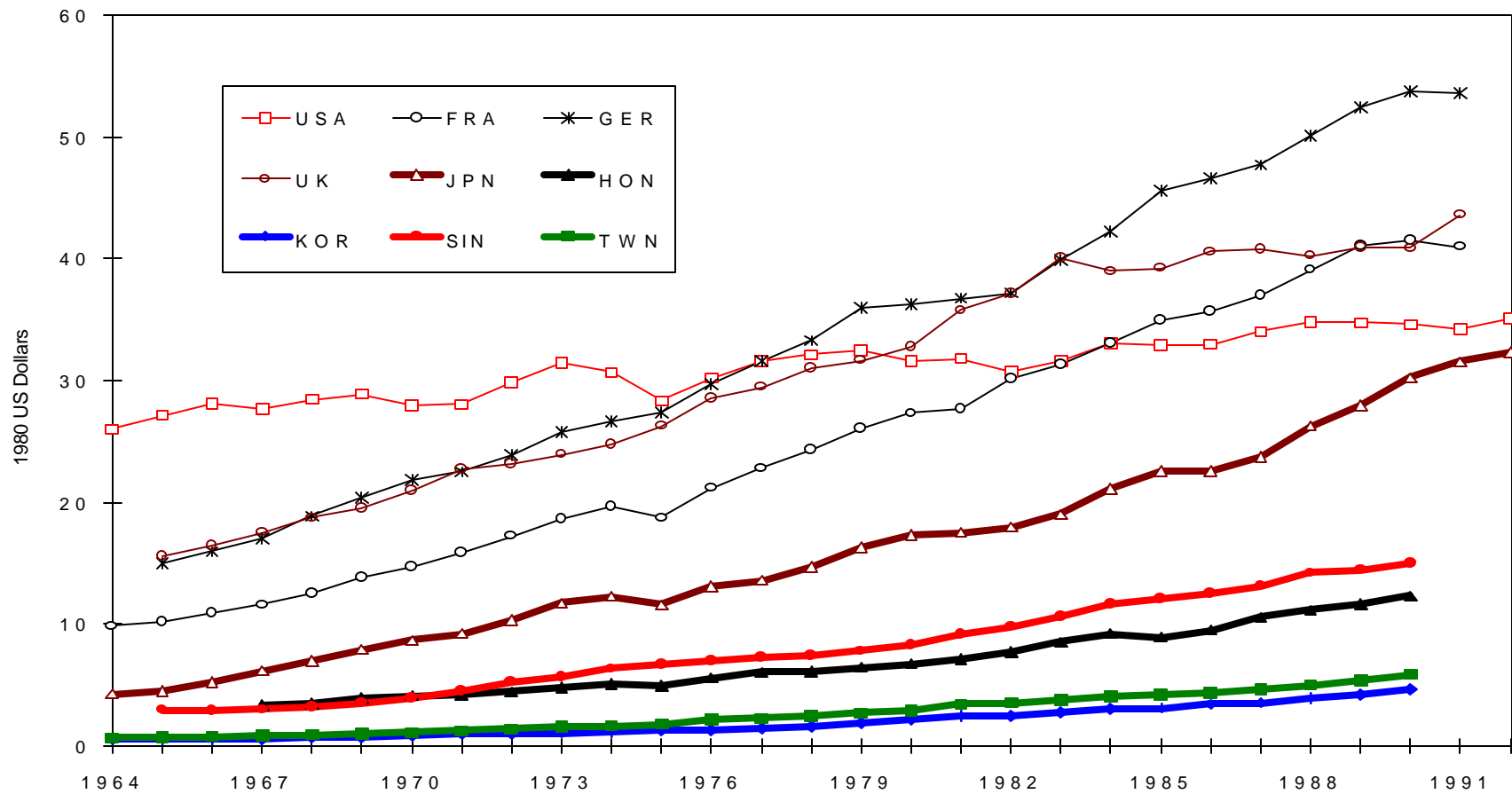
# Is East Asian Economic Growth Sustainable?

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- ◆ Past economic growth neither a miracle nor a mere bubble
  - ◆ Economic growth experience replicated in different East Asian economies
  - ◆ Sustained economic growth over decades
  - ◆ Recent crisis due to many factors, of which “irrational exuberance” was a major one
  - ◆ Economic fundamentals remain sound--high savings rates, investment in human capital, and more recently in R&D capital, entrepreneurship, market orientation
- ◆ Past economic growth input-driven rather than technical progress-driven--it is attributable to growth in inputs, particularly the efficient and rapid accumulation of tangible capital
- ◆ Considerable room for continuation of rapid tangible inputs-driven economic growth--tangible capital per unit labor still lags significantly behind the developed economies
- ◆ Intangible capital per unit labor, e.g., R&D capital, lags even further behind, offering additional opportunities for investment

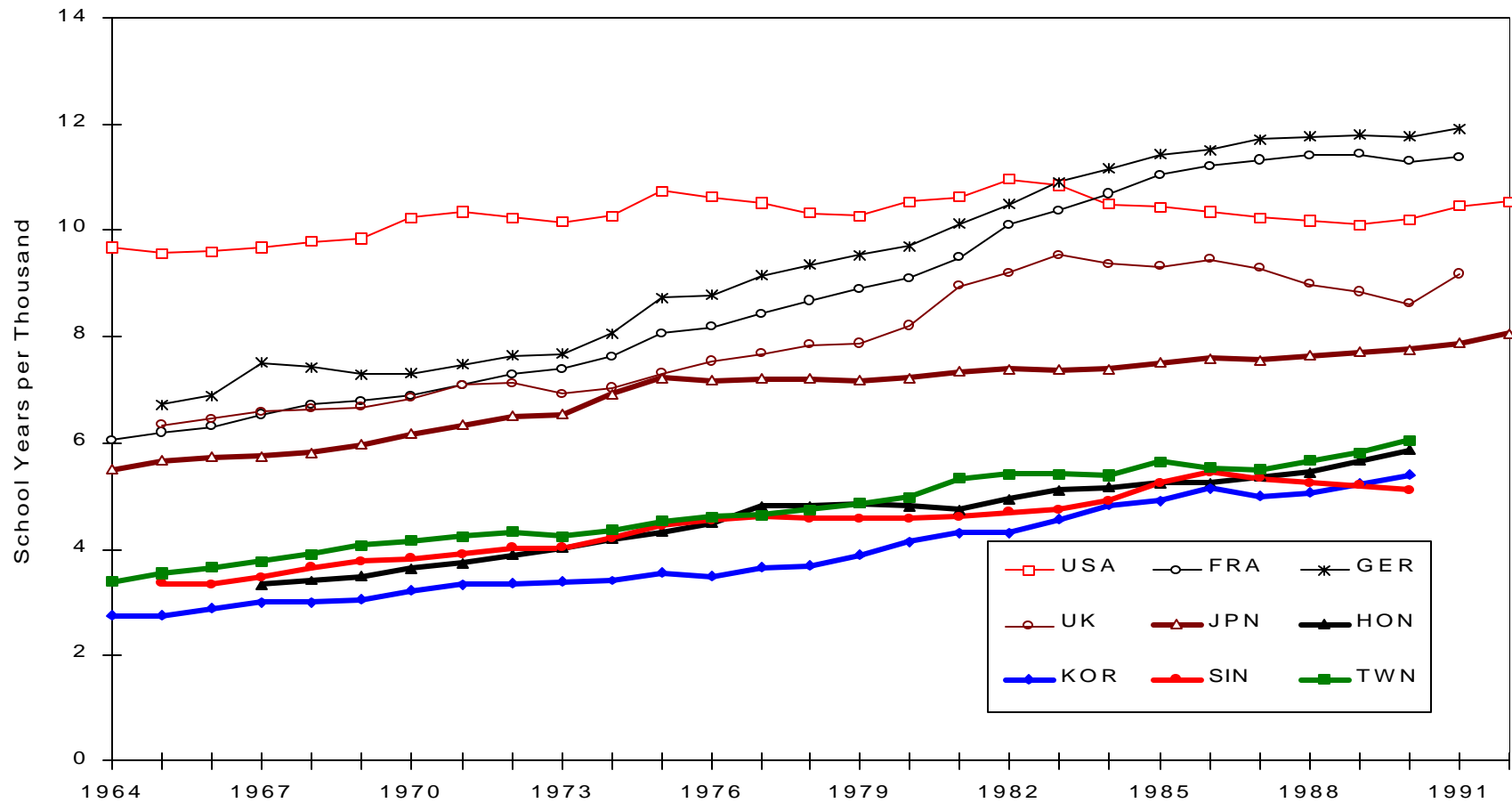
# Capital Intensity

Figure 4.1 Tangible Capital Stock per Labor Hour



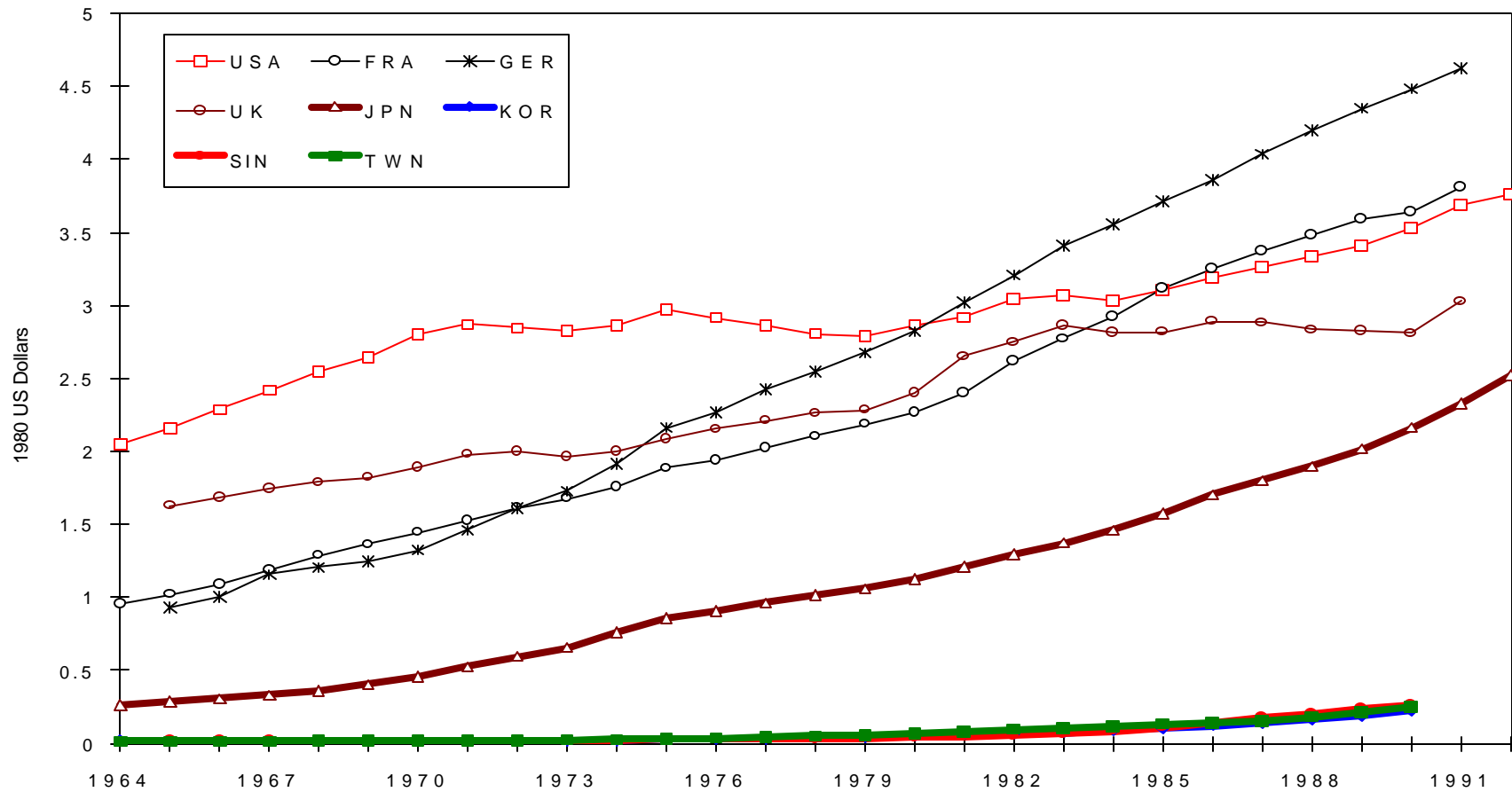
# Human Capital per Unit Labor

Figure 4.2 School Years per Labor Hour



# R&D Capital Stock per Unit Labor

Figure 4.3 R&D Capital Stock per Labor Hour



# Is East Asian Economic Growth Sustainable?

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- ◆ The attractiveness of investment in intangible capital depends on the protection of intellectual property rights, which in turn depends on whether a country is a producer of intellectual property
- ◆ Intangible capital is different from tangible capital in three important aspects:
  - ◆ Intangible capital is freely mobile across countries
  - ◆ Intangible capital is simultaneously deployable in different locations without diminution of its effectiveness (increasing returns in the utilization of intangible capital)
  - ◆ Intangible capital enhances the productivity of existing tangible capital whereas additional tangible capital diminishes the productivity of existing tangible capital

# Implications for East Asian NIEs (1)

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- ◆ Maintaining the growth in tangible capital
  - ◆ Encouraging savings and investment
  - ◆ Preserving a low-tax environment
  - ◆ Affirming property rights
  - ◆ Keeping inflation under control
  - ◆ Maintaining free flows of capital, labor and goods
  - ◆ Maintaining an orderly and stable foreign exchange market
  - ◆ Providing needed infrastructure
  - ◆ Avoiding open-ended social welfare programs



# Implications for East Asian NIEs (2)

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- ◆ Assuring the efficiency of tangible capital
  - ◆ Commitment to free trade
  - ◆ Continued liberalization and deregulation
  - ◆ Preserving open competition in all markets
  - ◆ Maintaining the rule of law
  - ◆ Providing needed infrastructure
  - ◆ Eschewing market intervention

## Implications for East Asian NIEs (3)

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- ◆ Closing the gap on intangible capital
  - ◆ Investment in human capital (formal, technical, on-the-job training, and re-training)
  - ◆ Investment in R&D capital
  - ◆ Investment in other forms of intangible capital (design, goodwill, brand name, market development, information systems and software, etc.)
  - ◆ Protection of intellectual property rights
  - ◆ Maintaining and creating competitive advantage

# Prospects for Future Economic Growth Remain Good

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- ◆ Prospects for continued economic growth in the East Asian NIEs will be good if these policies are pursued!
- ◆ The experience of developed economies, especially that of Japan, suggests that investment in R&D capital and other forms of intangible capital has high returns
- ◆ Because of its complementarity with tangible capital, investment in intangible capital can retard the decline in the marginal productivity of tangible capital
- ◆ There is evidence of positive technical progress in the more recent period
- ◆ Simultaneous expansions increase aggregate demands in all East Asian developing economies because of their significant intra-regional trade