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The Impact of the Financial Crisis and the Following Recession on the Economic Growth of the Seven East Asian Countries

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Abstracts

The financial crisis was a huge blow to the economic growth of the East Asian Countries and it seems that the impact still continues. Most of them lost huge potential output, decreased factor accumulation significantly, and responded differently in restructuring. The rate of factor accumulation did not recover to pre-crisis trends in most of the countries. Taiwan and Korea responded most quickly facing the recessions while Malaysia and Thailand were not adept in restructuring. Total factor productivity growth rates precipitated during the crisis and recession of 2001, however, soon rebounded without showing obvious downward trends.

Keywords: East Asian Economy, Financial Crisis, Economic Growth, Potential Output, TFP Growth

I. Introduction

The economic growth of the East Asian countries has been considered a myth and miracle drawing tremendous attention and provoking a lot of controversy about the sources of their economic growth. They recorded high economic growth rates for decades

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without so severe and prolonged recession before the financial crisis. The smoothly increasing trends of output, labor force, employment, and capital stock fluctuated after the crisis. The way of fluctuation and the response of each country to the crisis differed. Understanding how the East Asian countries cope with the challenge of the crisis will give some clue to understand the characteristics of each economy.

Researches on the causes of the financial crisis of the East Asian Economy are abundant. Among just a few of them: Park and Lee (2001) argued that East Asian countries resumed pre-crisis path of growth fast because Asian crisis was just a liquidity crisis caused by investor's panic. Barro (2001) reports that the Asian banking crisis has persisting negative effect on investment but does not have persisting negative influence on economic growth. Hong and Tornell (2005) examined how economies recovered from a currency crisis using a data set of over 100 developing countries. Among their findings: They supported Radelet and Sachs's hypothesis that economies with a liquidity crisis are expected to recover faster after a sharp initial drop (V-recovery), while economies with an insolvency crisis suffer from a protracted recession (U-recovery). Hong and Tornell found that Korea showed V-recovery while Thailand, Malaysia, and Indonesia showed U-recovery.

This research is not attempting to find the causes of the crisis. This research is a careful examination of the impact of the crisis on the economic growth of the seven East Asian countries (Korea, Japan, Taiwan, Singapore, Malaysia, Thailand, and Hong Kong). I compared the differences in GDP growth and factor accumulation, the differences in restructuring by calculating the growth rates of productivities, estimated the production functions to find out the role of technical progress in the economic growth of the countries, and I calculated the loss of potential output to compare the suffering of the countries due to the crisis. I included some of the countries which were not directly hit by the financial crisis to find out the indirect

impact of the crisis and the impact of the recession of 2001. Some countries are excluded because data are not available for the exact calculation of Total Factor Productivity and the estimation of production functions.

The structure of this paper is as follows. Section Ⅱ describes the impact of financial crisis on the output and the trade of the 7 East Asian countries. Section Ⅲ describes the impact of financial crisis on the factor accumulation. Section Ⅳ describes the trends of the TFP growth before and after the financial crisis. Section Ⅴ deals with the estimation of production functions for each country. Section Ⅵ deals with the calculation of potential GDP and output loss of each country. Section Ⅶ is the conclusion.

Ⅱ. The Impact on Output and Trade

During the last three decades before the financial crisis the East Asian countries recorded high economic growth rates as shown in <Table 1>. Japan slowed down from 7.7% of non-agricultural annual GDP growth during 1968~1977 to 3.2% during 1988~1997. Hong Kong and Taiwan slowed down moderately, however, the other countries maintained high growth rates during the three decades. Malaysia, Thailand, Singapore, Korea, and Taiwan recorded very high annual non-agricultural GDP growth rates of 9.6%, 9.0%, 8.4%, 8.3%, and 7.2% respectively during 1988~1997. Hong Kong and Japan also performed well recording 5.0% and 3.2% respectively during the same period. However, the high economic growth slowed down drastically after the crisis and the recuperating economies damped again due to the global recession in 2001. The growth rates rebounded after the crisis and the recession of 2001 but GDP growth rates during 1998~2002 were much lower than the pre-crisis levels. The East Asian countries also maintained high growth rates of imports and exports

【Table 1】 Growth Rates of Non-Agricultural GDP in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1968~1977	11.7	7.7	10.4	10.0	7.1	7.6	8.0
1978~1987	8.5	3.9	9.4	6.6	8.0	7.4	7.8
1988~1997	8.3	3.2	7.2	8.4	9.6	9.0	5.0
1998~2002	4.1	0.4	3.9	3.4	2.4	1.5	2.1

【Table 2】 Growth Rates of Imports in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1968~1977	18.2	8.3	16.1	11.9	6.8	10.9	9.1
1978~1987	9.1	2.2	9.8	8.1	7.4	5.9	12.7
1988~1997	12.5	7.1	9.9	11.9	16.4	12.1	9.9
1998~2002	6.1	1.4	3.0	0.2	1.6	3.4	1.5

【Table 3】 Growth Rates of Exports in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1968~1977	24.8	12.8	18.5	12.1	7.3	7.3	6.9
1978~1987	11.4	4.8	12.0	9.7	7.9	10.0	9.9
1988~1997	10.9	5.3	6.8	13.7	13.2	12.5	8.4
1998~2002	12.2	2.5	6.2	4.6	4.9	7.8	5.5

during the three decades before the crisis as shown in <Table 2> and <Table 3>. Malaysia, Thailand, Singapore, and Korea recorded more than 10% of import and export growth rates during 1988~1997. However, imports decreased sharply in 1998 in most of the countries. Korea and Thailand cut back on imports most severely recording -24.9% and -24.4% respectively followed by Malaysia (-20.8%), Singapore (-9.8%), Japan (-7.1%), and Hong Kong (-2.7%) in 1998. The annual average growth rates of imports during 1998~2002 decreased much in all the countries compared with pre-crisis levels as shown in <Table 2>. Exports also grew much less in most of the countries in 1998. The annual average growth rates of exports during 1998~2002

decreased much in most of the countries, however, the growth rate of exports increased in Korea and only slightly decreased in Taiwan during 1998~2002 compared with pre-crisis levels as shown in <Table 3>.

Ⅲ. The Impact on Factor Accumulation

Labor inputs and investment decreased significantly after the financial crisis and the recession of 2001 in all of the countries. Their unemployment rates have become chronically high after the crisis and the decreased growth rates of capital stayed low until recently.

1. Labor Inputs

Employment sharply decreased after the financial crisis in most of the countries. Korea cut back on labor most heavily. In 1998 the unemployment rate was highest in Korea recording 7.0% followed by 4.7% in Hong Kong, 4.1% in Japan, 3.4% in Thailand, 3.2% in Singapore and Malaysia, 2.7% in Taiwan. The average unemployment rates during the periods of 1998~2000 and 2001~2003 were higher than the period of 1987~1997 in all the countries except Malaysia as shown in <Table 4>. The average unemployment rates in Korea and Hong Kong increased more than 3% during 1998~2000 compared with 1987~1997. The situation improved in Korea in 2001~2003, however, in Hong Kong, Taiwan, Japan[1], and Singapore the average unemployment rates kept increasing to 6.8%, 4.9%, 5.2%, and 4.7% respectively during 2001~2003.

1) The unemployment rate in Japan was in increasing trend for decades and the financial crisis intensified the rising trend of unemployment rate. The unemployment rate was 1.1% in 1970, 2.0% in 1980, increased to 4.1% in 1998 and kept increasing until 2002 recording 5.4% in 2002.

【Table 4】 The Unemployment Rates in Percent (Annual Average)

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1987~1997	2.5	2.7	1.8	2.8	4.2	2.1	1.9
1998~2000	5.8	4.5	2.9	3.9	3.2	2.9	5.3
2001~2003	3.4	5.2	4.9	4.7	3.4	2.7	6.8

【Table 5】 Growth Rates of Labor Input in Percent (Annual Average)

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1968~1977	6.5	1.5	6.6	5.1	5.9	6.3	2.3
1978~1987	5.4	1.4	3.7	3.5	5.1	6.7	2.1
1988~1997	2.9	0.3	1.6	3.3	5.5	4.7	1.3
1998~2002	1.0	-0.8	-0.4	1.4	2.7	2.2	0.4
1998	-9.3	-1.1	0.1	0.6	-1.5	-0.9	-1.3
2001	1.6	-1.5	-8.3	1.9	5.4	3.0	1.4

The average annual growth rates of labor input[2] shows decreasing trends in all the countries except Malaysia even before the financial crisis as shown in <Table 5>. During 1998~2002 labor input even decreased in Japan and Taiwan by 0.8% and 0.4% respectively in annual average. In Malaysia and Thailand the annual growth rate of labor input decreased by 2.8% and 2.5% respectively during 1998~2002 compared with the period of 1988~1997.

2. Labor Productivity

Taiwan and Korea responded to recessions most quickly and drastically while Malaysia, Thailand, and Singapore were not adept in restructuring labor. Korea decreased labor input by 9.3% in 1998 accomplishing 4.0% of labor productivity growth while the growth rates of labor input in Malaysia, Hong Kong, Japan, Thailand, and Singapore were -1.5%, -1.3%, -1.1%, -0.9%, and 0.6% respectively in

2) Labor input is the non-agricultural employment times weekly hours of work times 50 as described in Appendix 1.

【Table 6】 Growth Rates of Labor Productivity in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1991~1997	3.8	2.1	5.2	4.6	4.1	2.0	3.2
1998~2002	3.1	1.1	4.3	2.0	-0.3	-0.7	1.7
1998	4.0	-0.8	5.1	0.2	-7.0	-9.6	-3.8
2001	0.7	1.8	6.8	-3.6	-4.9	-1.2	-0.9

1998 as shown in <Table 5>. Labor productivity decreased in Thailand significantly recording lowest growth rate of -9.6% in 1998 and Malaysia and Hong Kong also recorded very low growth rates of -7.0% and -3.8% respectively as can be seen in <Table 6>. Taiwan decreased labor input by 8.3% accomplishing high growth rate of labor productivity of 6.8% in 2001. During the period of 1998~2002 Korea and Taiwan kept high growth rate of labor productivity compared with pre-crisis levels while Malaysia, Thailand, and Singapore recorded much lower rates.

3. Capital Accumulation

In most of the countries the investment decreased sharply in 1998 and kept that low level until recently. Thailand and Malaysia decreased investment most drastically. In Thailand the ratio of investment to GDP was 41.4% in 1996 but decreased almost to half of the ratio in 1998 and stayed low until 2002 recording 21.7% in 2002 and in Malaysia the ratio was 48.5% in 1997 but sharply decreased to 30.1% in 1998 and to 28.2% in 2002. After the crisis the average ratio of investment to GDP decreased in all of the countries as shown in <Table 7>. As a result of lower investment and lower GDP growth capital accumulated much less than pre-crisis levels as shown in <Table 8>. The average growth rate of non-agricultural capital stock[3] in Thailand was 11.5% during 1991~1998 but decreased to 0.5%

3) The derivation of capital stock is described in Appendix 1.

【Table 7】 Ratio of Investment to GDP (Percent)

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1991~1997	35.0	27.6	25.5	34.2	44.5	38.8	22.1
1998~2002	28.9	26.7	25.3	30.9	28.8	21.7	20.6

【Table 8】 Growth Rates of Capital Stock in Percent (Annual Average)

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1991~1998	11.4	5.1	9.6	8.6	12.4	11.5	8.4
1999~2002	4.9	3.1	7.7	6.2	3.0	0.5	4.1

during 1999~2002. In Malaysia the growth rate of capital decreased from 12.4% during 1991~1998 to 3.0% during 1999~2002. In Korea also capital stock grew much less during 1999~2002 recording 4.9% compared with 11.4% during 1991~1998. In Hong Kong capital stock grew about 4% less after the crisis. In Singapore, Japan, and Taiwan the accumulation rate of capital stock decreased around 2% after the crisis. The growth rates of capital stock stayed much lower than pre-crisis levels until recently in all the countries.

Ⅳ. Total Factor Productivity (TFP) Growth

TFP growth is an important source of economic growth thus necessary to understand the impact of financial crisis on the economic growth. I calculated the TFP growth rate such as:

$$\Delta TFP = \Delta Y/Y - WS_L \Delta L/L - WS_K \Delta K/K \quad (1)$$

where ΔTFP is the annual growth rate of TFP, $\Delta Y/Y$ is the exponential growth rate of non-agricultural output, $\Delta L/L$ is the

【Table 9】 Average Annual Growth Rates of Total Factor Productivity in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1967~1976	2.56	3.31	1.62	-1.09	-1.20	0.71	3.36
1977~1986	0.82	1.46	3.91	0.07	1.33	0.01	2.73
1987~1996	3.92	1.35	4.13	2.99	2.23	2.19	1.61
1997~2002	1.98	0.08	2.23	-0.10	-1.36	-1.38	-0.42

【Table 10】 Contribution of TFP Growth to Output Growth in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1967~1976	21.7	39.1	15.2	-10.4	-18.0	8.9	47.9
1977~1986	9.8	35.5	42.2	1.0	16.6	0.2	35.3
1987~1996	42.5	40.2	53.8	36.1	23.2	21.8	27.9
1997~2002	47.8	12.4	49.7	-2.3	-41.5	-132.1	-16.2

exponential growth rate of non-agricultural labor input, $\Delta K/K$ is the exponential growth rate of non-agricultural capital stock, WS_L is $(S_{L(t-1)} + S_{L(t)})/2$ where $S_{L(t)}$ is the labor share which is the ratio of total labor cost[4] to output at time t, and WS_K is $1 - WS_L$ assuming constant returns to scale. The description of each variable can be found in Appendix 1.

During the three decades before the financial crisis TFP growth improved remarkably in most of the countries as shown in <Table 9> and <Table 10>. Singapore jumped from -1.09% of TFP growth rate in 1967~1976 to 2.99% in 1987~1996. The contribution of TFP[5] growth to output growth in Singapore also soared from -10.4% in 1967~1976 to 36.1% in 1987~1996. During the same periods the TFP growth rates improved from -1.20% to 2.23% in Malaysia, from 1.62% to

4) The derivation for the total labor cost can be found in Appendix 1.

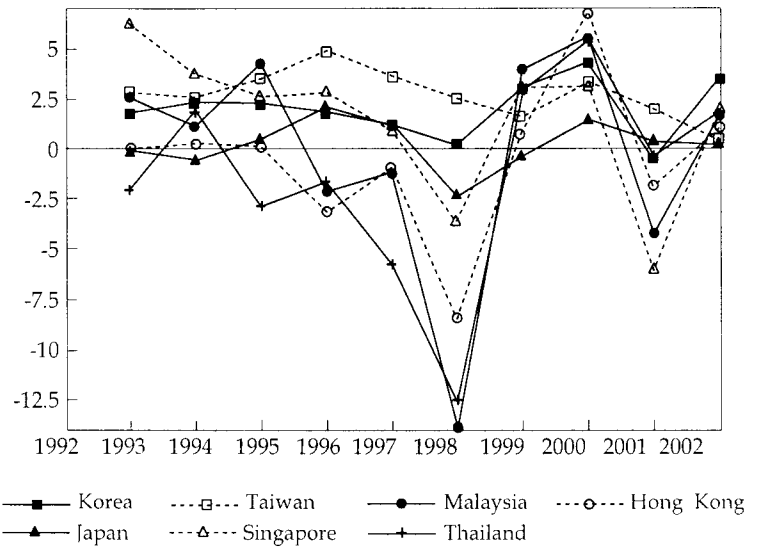
5) The contribution of TFP growth to output growth is the ratio of TFP growth rate to output growth rate.

4.13% in Taiwan, from 0.71% to 2.19% in Thailand, and from 2.56% to 3.92% in Korea. The contribution of TFP growth to output growth also remarkably improved in those countries as shown in <Table 10>. TFP growth rates decreased in Japan but the contribution of TFP growth to output growth stayed strong. However, both of TFP growth rate and contribution of TFP growth to output growth deteriorated in Hong Kong. The average TFP growth rate of Hong Kong during 1967~1976 was 3.36% but decreased to 2.73% during 1977~1986 and further decreased to 1.61% during 1987~1996. Contribution of TFP growth to output growth also decreased from 47.9% during 1967~1976 to 27.9% during 1987~1996.

The TFP growth rates decreased in all of the countries in 1998 compared with the pre-crisis rates as shown in <Figure 1>. In Thailand the TFP growth rates began deteriorating from 1995 recording -2.89% in 1995, -1.63% in 1996, and -5.78% in 1997. In 1998 the TFP growth rates precipitated to -13.87% in Malaysia, -12.57% in Thailand, -8.52% in Hong Kong, -3.66% in Singapore, and -2.36% in Japan. Korea recorded only 0.26% of TFP growth rate in 1998. The TFP growth rebounded in 1999 and 2000. The TFP growth rates of Malaysia, Thailand, Hong Kong, and Singapore made a huge jump to 5.56%, 5.39%, 6.87%, and 3.09% respectively in 2000. TFP growth of Korea and Japan also improved much in 2000 recording 4.32% and 1.43% respectively. TFP growth deteriorated again in 2001 but rebounded in 2002 in most of the countries. Thus TFP growth rebounded after the financial crisis and the recession of 2001 but did not show obvious downward trend as shown in <Figure 1>.

The average TFP growth rates of Taiwan and Korea during 1997~2002 decreased by about 2% but the contribution of TFP growth to output growth stayed as strong as the previous period showing that they were good in restructuring during the recessions. However Thailand and Malaysia did not respond quickly to the two recessions. The contribution of TFP growth to output growth precipitated to

Figure 1 Growth Rate of Total Factor Productivity in Percent



-132.1% and -41.5% in Thailand and Malaysia during the recessions. The contribution of TFP growth to output growth decreased much in Hong Kong and Singapore also.

V. Estimation of Production Functions

To measure the potential output I estimated production functions for each country. Consider the following translog production function and its share equation under the assumption of constant returns to scale:

$$\ln(Y/K) = B_0 + B_L \ln(L/K) + B_T T + 0.5(B_{LL} \ln(L/K)^2 + B_{TT} T^2) + B_{LT} \ln(L/K) T \quad (2)$$

$$S_L = B_L + B_{LL} \ln(L/K) + B_{LT} T \quad (3)$$

【Table 11】 Sample Period and ρ for Each Country

	Sample Period	ρ
Korea	1976~2002	0.8
Japan	1980~2002	0.8
Taiwan	1978~2002	0.7
Singapore	1983~2002	0.7
Malaysia	1968~2002	0.7
Thailand	1970~2002	0.8
Hong Kong	1975~2002	0.7

where[6] Y is non-agricultural GDP, K is non-agricultural capital stock excluding residential buildings, L is non-agricultural labor, T is the index of the technological progress, and S_L is the labor share which is the ratio of the value of non-agricultural labor to the non-agricultural output. Detailed description of the variables can be found in Appendix 1. For estimation purposes stochastic disturbance terms have been added to Equation (2) and (3). I assumed that the disturbances ε_t's are first order autoregressive such that: $\varepsilon_t = \rho\varepsilon_{t-1} + \mu_t$ and μ_t is distributed *i.i.d.* over time. I applied different ρ's for each country and the sample periods for the yearly data of each country are also different as shown in <Table 11>. I used 3SLS estimation procedure and the instrumental variables for the estimation are all exogenous variables and their squares lagged one and two periods, and time and its square.

Estimation results are summarized in <Table 12>. The elasticities are calculated from the estimated production functions as shown in <Table 13>. The elasticity of labor is high in Korea, Taiwan, and Japan recording 0.779, 0.762, and 0.707 respectively while Thailand, Singapore, Hong Kong, and Malaysia shows lower rates of 0.583, 0.565, 0.556, and 0.518 respectively. Technical progress in Taiwan and

6) $\alpha_{LL}, \alpha_{tt}, \alpha_{Lt} = 0$ for the model of Malaysia and Thailand.

【Table 12】 Estimation Results for Each Country

〈Korea〉

Parameter	Estimate	Standard Error
B0	-1.19963	.413773
BL	.835300	.063067
BT	.091156	.028527
BLL	-.080696	.098062
BTT	-.238317E-02	.103948E-02
BLT	-.595802E-02	.632715E-02

Equation	R^2	DW
Output	0.985	1.229
Labor Share	0.640	1.447

〈Japan〉

Parameter	Estimate	Standard Error
B0	-.740207	.249612
BL	.819573	.037415
BT	.055470	.018072
BLL	-.015462	.065529
BTT	-.184371E-02	.726326E-03
BLT	-.511183E-02	.380355E-02

Equation	R^2	DW
Output	0.992	1.580
Labor Share	0.931	1.680

〈Taiwan〉

Parameter	Estimate	Standard Error
B0	-1.33886	.257363
BL	.875712	.076432
BT	.098689	.019360
BLL	-.025543	.085368
BTT	-.246324E-02	.806489E-03
BLT	-.542289E-02	.596923E-02

Equation	R^2	DW
Output	0.98	1.78
Labor Share	0.80	1.03

〈Singapore〉

Parameter	Estimate	Standard Error
B0	-1.77370	.460911
BL	.632280	.127545
BT	.122774	.032066
BLL	.310874	.223477
BTT	-.258671E-02	.128001E-02
BLT	.015098	.012022

Equation	R^2	DW
Output	0.86	2.57
Labor Share	0.05	2.66

〈Malaysia〉

Parameter	Estimate	Standard Error
B0	-.092628	.060059
BL	.517857	.917892E-02
BT	.521747E-02	.239475E-02

Equation	R^2	DW
Output	0.93	1.45
Labor Share	0.88	1.90

〈Thailand〉

Parameter	Estimate	Standard Error
B0	-.106557	.070241
BL	.582592	.020329
BT	.860812E-02	.316407E-02

Equation	R^2	DW
Output	0.90	1.17
Labor Share	0.66	1.66

〈Hong Kong〉

Parameter	Estimate	Standard Error
B0	-.576521	.217916
BL	.324409	.121874
BT	.049824	.017210
BLL	.389622	.193663
BTT	-.225046E-03	.881644E-03
BLT	.026823	.013036

Equation	R^2	DW
Output	0.96	2.01
Labor Share	0.35	2.19

【Table 13】 Elasticity of Labor and Technical Progress in Percentage, Annual Average (Figures in the Parentheses are Standard Errors Calculated at Respective Sample Means of the Inputs)

	Elasticity of Labor	Technical Progress
Korea	0.779(0.016)	0.040(0.0062)
Japan	0.707(0.008)	0.014(0.0029)
Taiwan	0.762(0.009)	0.042(0.0032)
Singapore	0.565(0.021)	0.028(0.0038)
Malaysia	0.518(0.009)	0.005(0.0024)
Thailand	0.583(0.020)	0.009(0.0032)
Hong Kong	0.556(0.021)	0.021(0.0056)

Korea shows high rates of 0.042 and 0.040 respectively. Singapore, Hong Kong, and Japan record 0.028, 0.021, and 0.014 of technical progress while Thailand and Malaysia record lower rates of 0.009 and 0.005 respectively.

Ⅵ. Potential GDP and Output Loss

Estimating potential outputs is mainly used for monetary and fiscal policies. Potential output — the trend growth in the productive capacity of the economy — is an estimate of the level of GDP attainable when the economy is operating at a high rate of resource use.[7] Various methods can be used to calculate potential output but two alternative methods are popular. The first method involves smoothing real GDP using Hodrick-Prescott filter. This method determines the trend in real GDP by calculating weighted moving average of GDP over time.[8] The second approach uses production

7) See Congressional Budget Office (2001), "CBO's Method for Estimating Potential Output: An Update."

8) See Giorno, C. *et al.* (1995).

function relationship and the factor inputs. The parameters of production function can be estimated or obtained from the data using non-statistical method by adjusting TFP and labor input.

I calculated potential outputs from the estimated production functions after adjusting each labor input to its potential level for the post-crisis samples since labor inputs drastically decreased after the crisis. The capital input has not been adjusted to create a potential level because the unadjusted capital input already represents its potential contribution to output.[9] The derivation of the potential values of labor force, employment, and hours of work and natural rates of unemployment for each country can be found in Appendix 2.

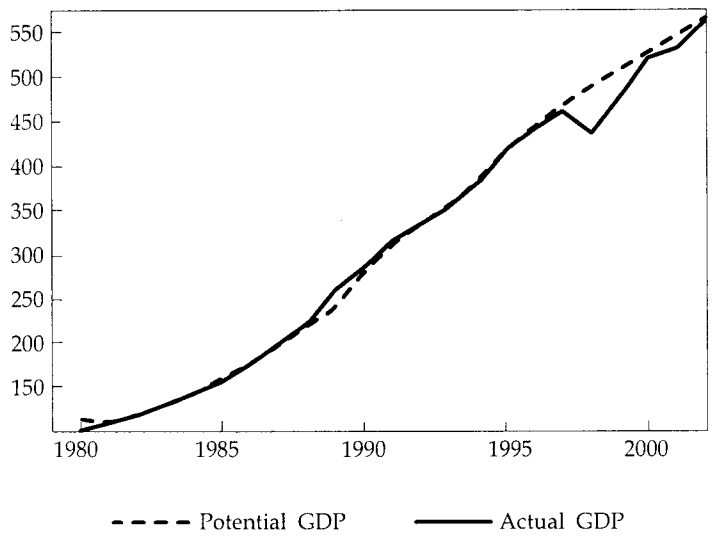
The graph of actual GDP and potential GDP for each country can be seen in <Figure 2>. Thailand lost most. The economic growth of Thailand was so severely damaged that it is well below the trend until recently. In Thailand the cumulative ratio of GDP gap (potential GDP minus actual GDP) to potential GDP from 1997 to 2000 was 43.0% as shown in <Table 15>. Hong Kong, Korea, and Malaysia also lost much of potential GDP recording 23.5%, 19.6%, and 18.2% respectively during the same period. Singapore and Japan lost less recording 6.7% and 5.1% respectively. Taiwan did not lose potential GDP during 1997~2000.

Thailand lost most again after the recession of 2001 recording 16.6% of potential GDP loss during 2001~2002. Singapore was relatively less affected during the financial crisis, however, experienced second most output loss after the 2001 recession losing 11.4% of potential output during 2001~2002. Malaysia lost 9.7% of potential GDP. Taiwan was not affected by financial crisis but lost much after the 2001 recession recording 9.4%. Hong Kong, Korea, and Japan were less affected after the 2001 recession recording 6.3%, 3.6%, and 1.7% respectively. Considering the two recessions Thailand lost 59.6% of potential output during 1997~2002 followed by Hong Kong, Malaysia, Korea, and

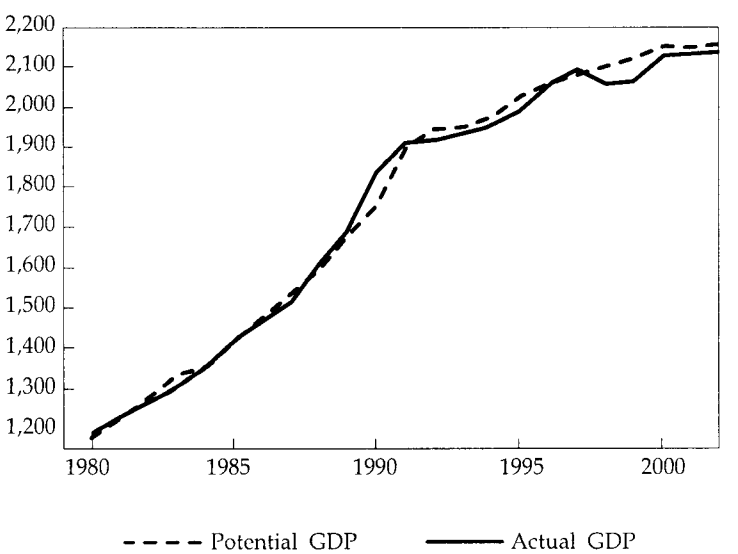
9) See CBO's Method for Estimating Potential Output.

Figure 2 Potential and Actual Output (1985 US billion Dollars)

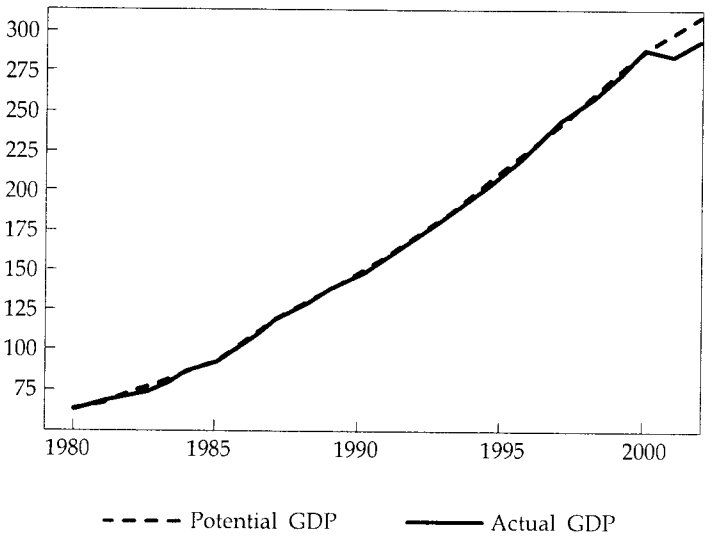
〈Korea〉



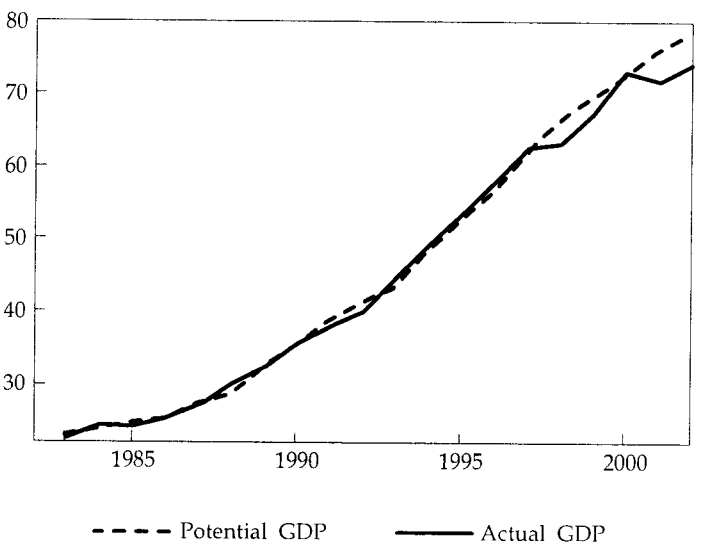
〈Japan〉



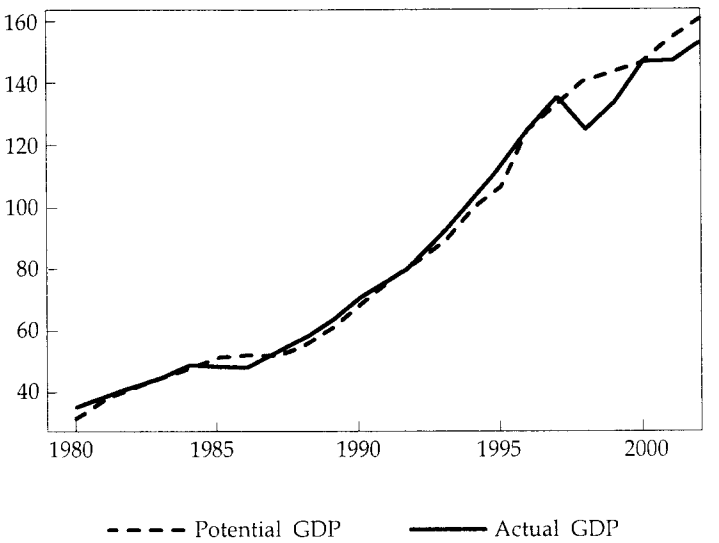
〈Taiwan〉



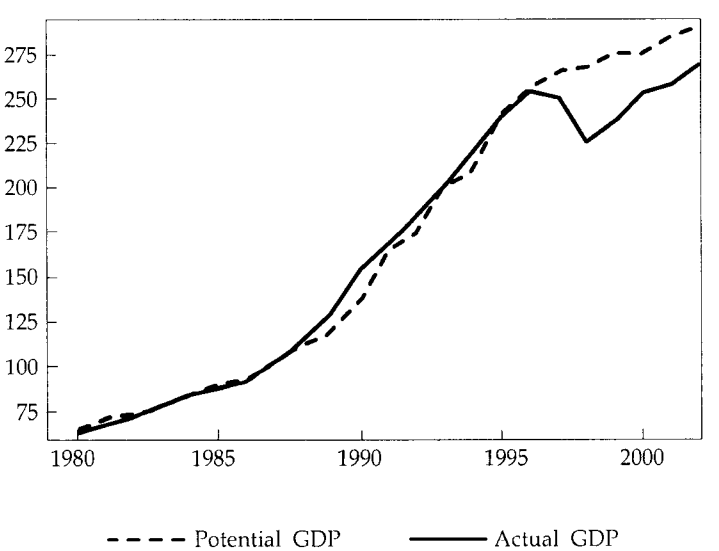
〈Singapore〉



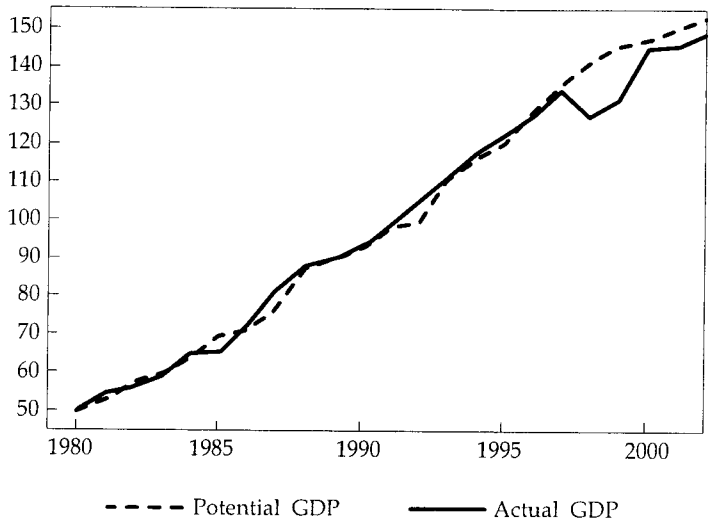
〈Malaysia〉



〈Thailand〉



〈Hong Kong〉



【Table 14】 The Ratio of GDP Gap to Potential Output in Percent

	Korea	Japan	Taiwan	Singapore	Malaysia	Thailand	Hong Kong
1997~2000	19.6	5.1	-0.4	6.7	18.2	43.0	23.5
2001~2002	3.6	1.7	9.4	11.4	9.7	16.6	6.3
1997~2002	23.2	6.8	9.1	18.2	27.9	59.6	29.8
2002	0.6	0.9	5.1	5.8	4.7	7.0	3.0

Singapore recording 29.8%, 27.9%, 23.2%, and 18.2% respectively. Taiwan and Japan were affected relatively less recording 9.1% and 6.8% respectively.

Korea is closing the GDP gap in 2002 and the GDP gap in Japan is relatively small. However, the other countries have not yet closed the gap until 2002 expecting more loss of potential output. The ratio of GDP gap in Thailand, Singapore, Taiwan, Malaysia, and Hong Kong was 7.0%, 5.8%, 5.1%, 4.7%, and 3.0% respectively in 2002 as shown in <Table 14>.

Ⅶ. Conclusion

The financial crisis gave severe and prolonged damage to the economic growth of the East Asian countries, which they have never experienced before. The impact of financial crisis is persistent in that output, trade, labor force, employment, and investment do not still recover to pre-crisis trends. GDP decreased so much in Thailand that it is still well below the trend level.

Labor input was decreasing even before the financial crisis in most of the countries and sharply decreased after the crisis and the following recession. In the loss of employment Korea and Hong Kong suffered most. Labor force decreased in Korea due to the high unemployment rate during the crisis and in Hong Kong increased unemployment rate after the crisis kept increasing until recently. The growth rate of physical capital lowered most in Thailand and Malaysia after the crisis. The lowered growth rates of physical capital after the crisis and the recession of 2001 stay low until recently in all of the countries. Due to the slowdown of factor accumulation it seems that factor accumulation can not contribute to the future economic growth of the East Asian countries as much as before.

The financial crisis and the recession of 2001 gave a huge loss of potential output. Thailand lost potential output most followed by Hong Kong but the loss of Thailand doubled the loss of Hong Kong. Malaysia, Korea, and Singapore also lost much potential output. Japan and Taiwan experienced relatively moderate loss of potential output. Most of them have not yet closed the GDP gap until recently expecting more loss of potential output.

Taiwan and Korea were quickest in restructuring facing the financial crisis and the recession of 2001 recording highest TFP growth rates and technical progress while Thailand and Malaysia recorded lowest TFP growth rates after the crisis. TFP growth improved

remarkably during the three decades before the financial crisis in most of the countries but precipitated after the crisis and the recession of 2001. However, TFP growth soon rebounded not showing obvious downward trends. Thus TFP growth could be a driving force for the future economic growth of the countries.

〈Appendix〉

1. Data Description

The Output (Y) is GDP excluding Agriculture and subtracting net indirect taxes. Non-residential and non-agricultural capital stock has been used for the Capital (K). I generated four categories of capital stock (non-residential buildings, other construction, transportation equipment, machinery and other equipment)[10] separately and added them up to form Capital (K). I used perpetual inventory method to derive each category of capital stock and derived base year capital stock using the formula $K_{i0} = I_{i0}/(g_i + \delta_i)$, $i = 1, 2, 3, 4$, where K_{i0} is the base year capital of ith category of capital, I_{i0} is the gross fixed capital formation of ith category excluding agriculture at the base year, g_i is the growth rate of I_{i0} for the first ten years, δ_i is the depreciation rate of each category. I applied the depreciation rates of 0.0304, 0.03024, 0.2079, and 0.1376 for non-residential buildings, other construction, transportation equipment, and machinery and other equipment respectively. These values are the unweighted average of the depreciation rates of various asset types from the table of Jorgenson and Yun (1990). The depreciation rate of total capital stock is the weighted average of the depreciation rates of categorized

10) This classification is in accordance with the definitions and classifications in the United Nations Systems of national Accounts (SNA).

capital stocks. Labor input is total man-hours worked in the non-agricultural sector. Total man-hours have been calculated by multiplying total non-agricultural employment times average weekly hours times 50. Total labor cost is compensation of employees in non-agricultural sector times TOEM/EMP where TOEM is total non-agricultural employment and EMP is employees in the non-agricultural sector. PPP values for 1985 from Penn World Table Version 6.1 (2002) have been used to convert data to US dollars.

2. The Derivation of the Potential Values of Labor Force, Employment, and Hours of Work and Natural Rates of Unemployment

Korea : Labor force decreased sharply in 1998 thus potential labor force for 1998~2002 was obtained by multiplying non-agricultural labor force participation rate[11] of 1997 to the population of non-agricultural household in 1998~2002. Natural level of employment for 1998~2002 was obtained by multiplying one minus natural rate of unemployment to the non-agricultural labor force. I assumed natural rate of unemployment was average unemployment rate during 1990 to 1997, which is 0.02725. Weekly hours of work of 1998~2002 has been adjusted by running OLSQ to the weekly hours of work of 1990~1997 to obtain potential hours of work. Potential labor input for 1998~2002 was obtained by multiplying potential employment to the potential weekly hours of work times 50.

Japan : Piecewise linear regression model[12] was applied to estimate the potential labor force using the labor force sample of 1990~2002. Natural rate of unemployment for the period of 1990~

11) Labor force participation rate is the ratio of labor force to the population of age 15 or older.

12) See Pindyck and Rubinfeld (1998).

2002 was estimated by running the ordinary least squares on the unemployment rates of 1990~1997. Natural level of employment for 1995~2002 was obtained by multiplying one minus natural rate of unemployment to the non-agricultural labor force. Potential hours worked were assumed same to actual hours worked because the hours worked were stable during recent years.

Taiwan : Piecewise linear regression model was applied to estimate the potential labor force using the labor force sample of 1994~2003. Natural rate of unemployment for the period of 1995~2002 was estimated by running the ordinary least squares on the unemployment rates of 1996~2000. Potential hours worked were estimated by running ordinary least squares on the sample of 1990~1997.

Singapore : Ordinary least squares estimation was applied to estimate the potential labor force using the labor force sample of 1993~2003. Natural rate of unemployment for the period of 1998~2002 was estimated by running the ordinary least squares on the unemployment rates of 1990~1997. Potential hours worked were estimated by running ordinary least squares on the sample of 1990~1997.

Malaysia : Ordinary least squares estimation was applied to estimate the potential labor force using the labor force sample of 1991~2001. Natural rate of unemployment for the period of 1998~2002 was obtained by taking the average of unemployment rates of 1991~1997. Potential hours worked were not adjusted but assumed same as actual hours of worked of 1984 because data were not available for 1985~2002.

Thailand : Ordinary least squares estimation was applied to estimate the potential labor force using the labor force sample of 1990~2002. Natural rate of unemployment for the period of 1997~

2002 was obtained by taking the average of unemployment rates of 1991~1997. Potential hours worked of 1997~2002 were assumed same as actual hours of worked of 1999.

Hong Kong : The trend of labor force was stable thus potential labor force was assumed same as actual labor force. Natural rate of unemployment for the period of 1997~2002 was obtained by taking the average of unemployment rates of 1990~1997. Potential hours worked were assumed same as actual hours of worked of 1997~1998 because data were not available for 1999~2002.

Tables of Actual and Potential Values of Labor Force, Employment, Unemployment, and Hours of Work

〈Korea〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1998	18771	19465	17330	18935	7.0	2.725	45.9	46.82
1999	19096	19777	17765	19238	6.3	2.725	47.9	46.67
2000	19533	20099	18650	19551	4.1	2.725	47.5	46.51
2001	19941	20387	19125	19832	3.8	2.725	47.0	46.36
2002	20457	20696	19771	20132	3.1	2.725	46.2	46.20

〈Japan〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1995	62871	63119	60900	61198	3.15	3.04	43.6	43.6
1996	63427	63739	61300	61658	3.35	3.26	43.3	43.3
1997	64247	64331	62070	62088	3.40	3.49	42.5	42.5
1998	64353	64236	61710	61854	4.11	3.71	42.3	42.3
1999	64276	64147	61273	61627	4.68	3.93	42.3	42.3
2000	64238	64089	61204	61429	4.72	4.15	42.7	42.7
2001	64224	64063	60991	61263	5.03	4.37	42.2	42.2
2002	63625	63919	60213	60983	5.38	4.59	42.2	42.2

〈Taiwan〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Monthly)	Potential Hours of Work
1995	8239	8231	8091	8027	1.79	2.48	194.2	194.1
1996	8368	8373	8150	8156	2.60	2.58	193.3	193.5
1997	8530	8527	8298	8298	2.71	2.66	193.9	193.0
1998	8701	8699	8467	8457	2.69	2.79	190.2	192.4
1999	8871	8861	8611	8605	2.93	2.89	190.2	191.8
2000	9023	9011	8753	8742	2.99	2.99	190.1	191.2
2001	9092	9127	8677	8845	4.57	3.09	180.3	190.6
2002	9221	9220	8745	8926	5.17	3.19	181.4	190.0

〈Singapore〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1998	1932	1932	1870	1875	3.21	2.98	46.7	47.5
1999	1976	1990	1886	1928	4.56	3.10	46.8	47.6
2000	2192	2047	2095	1981	4.45	3.21	47.1	47.8
2001	2120	2105	2047	2034	3.44	3.33	46.1	47.9
2002	2129	2162	2017	2087	5.22	3.45	46.1	48.0

〈Malaysia〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1998	7214	7298	6983	7076	3.20	3.05	44.8	44.8
1999	7470	7561	7214	7331	3.43	3.05	44.8	44.8
2000	7850	7787	7610	7549	3.06	3.05	44.8	44.8
2001	8333	8267	8033	8015	3.61	3.05	44.8	44.8
2002	8328	8499	8057	8240	3.26	3.05	44.8	44.8

〈Thailand〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1997	16559	16470	16471	16234	0.90	1.42857	49.19	50.03
1998	16258	16251	15666	16019	3.40	1.42857	51.25	50.03
1999	17101	17260	16523	17014	3.00	1.42857	50.03	50.03
2000	17314	17263	16905	17016	2.40	1.42857	50.03	50.03
2001	18088	18122	17176	17863	3.32	1.42857	50.03	50.03
2002	18359	18269	17715	18008	2.44	1.42857	50.03	50.03

〈Hong Kong〉

Year	Labor Force ('000)	Potential Labor Force	Employ-ment	Potential Employ-ment	Unemploy-ment Rate(%)	Natural Unemployment Rate(%)	Hours of Work (Weekly)	Potential Hours of Work
1997	3235	3235	3164	3165	2.200	2.14687	45.2	45.2
1998	3276	3276	3122	3206	4.675	2.14687	45.2	45.2
1999	3320	3320	3112	3248	6.250	2.14687	45.2	45.2
2000	3374	3374	3207	3302	4.950	2.14687	45.2	45.2
2001	3427	3427	3252	3353	5.100	2.14687	45.2	45.2
2002	3487	3487	3232	3412	7.325	2.14687	45.2	45.2

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