

ACADEMIA STUDIES IN ASIAN ECONOMIES

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*Economic Efficiency and Productivity Growth in the Asia-Pacific Region*  
*Edited by Tsu-Tan Fu, Cliff J. Huang and C.A. Knox Lovell*

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# **Economic Efficiency and Productivity Growth in the Asia-Pacific Region**

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## 2. An Alternative Tale of Two Cities\*

C.A. Knox Lovell and Yih Pin Tang

### 1 INTRODUCTION

Hong Kong and Singapore are similar in a number of ways, and different in others. Both were at one time British colonies serving as international trading centers. Eventually both developed export-dependent domestic manufacturing sectors. Both passed through a similar set of industries, graduating from textiles to electronics to financial services. Both are city-states, with little in the way of agricultural activity. Both have grown rapidly in recent decades, and have participated fully in the East Asian economic miracle. However they have followed very different paths to their economic success. The Hong Kong economy has developed within a freewheeling *laissez-faire* framework, with growth having been driven largely by relatively unfettered domestic entrepreneurs, while the Singapore economy has to a much greater degree been guided by an interventionist government policy which has relied on high rates of domestic saving and direct foreign investment to funnel resources into the sectors it has favored.

The value of output per capita in both economies has grown at roughly the same rapid rate during the past several decades. Estimates vary but all agree that GDP in both economies has grown at rates in excess of 6 percent per annum since 1960. This raises the obvious question of what factors might explain such high and sustained rates of economic growth in two economies which have taken such different approaches to development. The World Bank has attributed high rates of growth in Hong Kong and Singapore (and several other Asian economies as well) to

\* This chapter is based on a paper presented to the Taipei International Conference on Efficiency and Productivity Growth held at the Institute of Economics, Academia Sinica, Taipei, Taiwan, ROC, 20-21 June, 1997, and to the Council for Economic Planning and Development, Taipei, Taiwan, ROC, 16 December, 1997. We received many helpful comments at both presentations, and we are also grateful for advice and guidance received from Tsu-Tan Fu and Cliff Huang.

generally sound macroeconomic management. Growth accountants, on the other hand, have tended to attribute high rates of economic growth in the region to rapid, and ultimately unsustainable, factor accumulation in the face of unimpressive rates of productivity growth (essentially zero in the case of Singapore). Although much is made of these two divergent interpretations, they are not necessarily inconsistent. Sound macroeconomic management can of course establish an institutional framework within which productivity growth flourishes. However in the absence of significant productivity growth, sound macroeconomic management in other respects would seem to be a prerequisite for rapid economic growth. Since productivity growth is neither necessary nor sufficient for economic growth, much less growth in economic well-being, and since the Asian productivity growth literature is already vast, we prefer to focus on the quality of macroeconomic management in Asia in general, and in the two city-states in particular.

The quality of a country macroeconomic management is difficult to define, and even more difficult to observe directly. However it is possible to evaluate the quality of a country's macroeconomic management indirectly, by evaluating the observable outcomes of policy decisions undertaken by its economic decision-makers. This is the approach we take in this study. We make no contribution to the contentious issue concerning the contribution of productivity growth to economic growth in Hong Kong and Singapore. Our contribution is to conduct a pair of empirical exercises in which we examine the quality of macroeconomic management in Hong Kong and Singapore, relative to that in a number of other relevant countries. One exercise is backward-looking, and the other is forward-looking.

This chapter is organized as follows. In section 2 we briefly review the various competing interpretations of the recent economic performances of Hong Kong and Singapore. In section 3 we conduct our backward-looking evaluation of the quality of macroeconomic management these two city-states have enjoyed. We find evidence that the Singapore interventionist approach has been just as effective as the Hong Kong hands-off approach, although we also find that neither approach has been as effective as that of Taiwan. In section 4 we conduct our forward-looking evaluation of the quality of macroeconomic management in the two city-states as they position themselves for the twenty-first century. Results of this evaluation suggest that despite certain shortcomings, Hong Kong appears much better prepared than Singapore for continued rapid economic growth in the near future.<sup>1</sup> Section 5 contains a summary of our findings, and some speculative ruminations in light of the tumultuous events of 1997.

## 2 COMPETING INTERPRETATIONS OF THE RECENT ECONOMIC PERFORMANCE OF HONG KONG AND SINGAPORE

Impressions of the recent economic performance of Hong Kong and Singapore, and of the role of productivity change in this performance, come from four sources. The World Bank (1993) has adopted a laudatory stance. Young (1992, 1995) and Krugman (1994) have questioned the World Bank's favorable view. The rest of the academic community has, perhaps not surprisingly, expressed divergent opinions. Finally, regardless of past performance, the nonacademic community is optimistic about future prospects. In this section we briefly review each of these positions.

The World Bank has referred admiringly to the 'economic miracle' achieved by the high performing Asian economies, which it categorizes as the Four Tigers (Hong Kong, the Republic of Korea, Singapore and Taiwan) and the newly industrializing economies (Indonesia, Malaysia and Thailand). It attributes the economic miracle to the fact that they got the basics right. Among the basics these seven economies have got right are, to varying degrees in various countries, (i) declining rates of population growth and declining income inequality, (ii) secure property rights embodied in the legal framework, (iii) high domestic savings rates which sustained high rates of private domestic investment, (iv) an openness to foreign technology and foreign direct investment, (v) investment in human capital and flexible labor markets, (vi) competent and honest bureaucracies and effective systems of public administration, and (viii) sound macroeconomic management. We will return to the claim of sound economic management in sections 3 and 4.

However recently a revisionist view has emerged. Originally propounded by Young (1992, 1995), and popularized by Krugman (1994), this view claims that (i) the East Asian economic miracle is overrated, particularly in Singapore, and (ii) output growth in Singapore, and to a lesser extent in Hong Kong, has been due to unsustainable input growth, and the days in which Singapore can continue to sustain accumulation-driven growth are clearly numbered. Or, as *The Economist* (1995) so eloquently put it, 'If you invest in more sausage machines and employ more sausage-makers, of course you will make more sausages. Where's the miracle? Growth will slow down when you run out of extra sausage-makers.'

The following calculations, taken from Young (1995), illustrate the revisionist contention that economic growth in these two city-states has been accumulation-driven, particularly in Singapore. Over the period 1966-1990 Young calculates that Singapore's real GDP grew at an

average annual rate of 8.7 percent, while its average annual growth rates of quality-adjusted capital and labor were 11.5 percent and 5.7 percent respectively. For productivity to have grown at a 2 percent average annual rate would have required an average labor expenditure share of 83 percent. However Young calculates that labor expenditure share averaged 51 percent over the period, which implies an average productivity growth rate of just 0.2 percent. It follows that Singapore's rapid economic growth during the period was due almost exclusively to rapid factor accumulation rather than to productivity growth.

Young paints a somewhat brighter picture for Hong Kong, for which he calculates that real GDP growth averaged 7.3 percent per annum over the same period, while growth rates of quality-adjusted capital and labor averaged 8.0 percent and 3.2 percent respectively. With an estimated average labor expenditure share of 63 percent, a 2.3 percent average annual productivity growth rate is implied. While Hong Kong's productivity growth has been far more impressive than that of Singapore, it still appears that less than a third of Hong Kong's economic growth can be attributed to productivity growth.

The search for an explanation for rapid rates of economic growth in the region has attracted a substantial academic effort. Perhaps not surprisingly, findings have been mixed, although there has been some support for the revisionists' claim of negligible productivity growth in Singapore. Kim and Lau (1994) used a meta-production function approach and concluded that (i) capital accumulation accounted for the vast majority of economic growth achieved by the Four Tigers; and (ii) the hypothesis of no technological progress could not be rejected for these economies collectively. This conclusion was questioned by Harberger (1996), who noted that differences in GDP growth rates between high-growth subperiods and low-growth subperiods were highly correlated with, and perhaps caused by, differences in productivity growth rates between these subperiods. Thus the Young finding of negligible productivity growth in Singapore over a three-decade period is not inconsistent with the assertion that variation in growth rates from one decade to the next are attributable to variation in productivity growth rates from one decade to the next. The Harberger point is echoed by Hsiao and Hsiao (1997).

Easterly (1995) ran a variety of conventional growth regressions based on a large number of countries over several decades. He found persistent large positive growth regression residuals for Hong Kong and Singapore. However he attributed these residuals not to productivity growth, but to (i) the fact that both economies are city-states which are likely to have benefited from externalities associated with migration, urbanization and

density; and (ii) quantitatively and statistically significant effects of various government policies on growth. We will take up Easterly's emphasis on government policies in sections 3 and 4.

Nadiri and Son (1998) specified a model with two outputs (domestic output and exports), five inputs (labor, physical capital, human capital, foreign capital and imports), and a time trend to account for technical change. They used data from six countries (Singapore, Korea, Taiwan, Thailand, Malaysia and Japan; requisite data were unavailable for Hong Kong) over the 1969-1990 period. They found that most of Singapore's output growth was associated with international trade, only 5 percent being attributable to technical progress. International trade was also emphasized by Gapinski (1997), who defined productivity growth to include all sources of economic growth other than growth in input quantities, primarily growth in input quality and international trade. On the basis of this definition he found that productivity growth accounted for well over half of output growth in both Hong Kong and Singapore during the 1961-1990 period. Gapinski and Western (1998) applied a similar approach to modeling economic growth in Hong Kong, and again found growth in international trade and growth in input quality to account together for over half of Hong Kong's economic growth.

More recently still, a more optimistic view has emerged from a variety of sources. The World Economic Forum ranks Singapore and Hong Kong first and second in terms of economic competitiveness based on 155 indicators for 49 countries. The International Institute for Management Development ranks Singapore and Hong Kong second and third in terms of an alternative notion of economic competitiveness based on 224 indicators for 46 countries.<sup>2</sup> A group of 11 institutes, led by the Fraser Institute, the Cato Institute and the Institute of Economic Affairs, ranks Singapore and Hong Kong second and first in terms of economic freedom based on 17 indicators for 102 countries.<sup>3</sup> Finally the Third International Maths and Science Study ranks Singapore and Hong Kong first and fourth in maths education and first and twenty-fourth in science education among 41 nations.<sup>4</sup>

It is hard to know what to make of all these conflicting claims. Singapore and Hong Kong apparently 'got the basics right' in the past, and they currently rank at or near the top of international rankings in terms of economic competitiveness and economic freedom. Yet productivity growth, which is the engine of economic growth and prosperity, has apparently lagged in Hong Kong and gone AWOL in Singapore. Perhaps the World Bank is off the mark, and Singapore and, to a lesser degree, Hong Kong, failed to get the basics right after all. In section 3 we conduct our own backward-looking investigation into the

quality of macroeconomic management in these two countries during the recent past. Perhaps the optimists are also off the mark, and Singapore and Hong Kong are not well positioned to achieve rapid productivity gains in the near future. In section 4 we conduct a forward-looking investigation into the future potential of these two economies.

### 3 AN ALTERNATIVE TALE OF TWO CITIES

Easterly (1995) concluded that the success of the Four Tigers was due largely to 'the old prosaic fundamentals' of sound macroeconomic management. Our objective in this section is to follow up on the Easterly conclusion by taking yet another look backward at the past performance of Hong Kong and Singapore, by conducting an evaluation of three conventional backward-looking indicators of the quality of macroeconomic management in these two countries. The common logic underlying the three indicators is that if the unobservable quality of a country macroeconomic management has been high, then the observable consequences of its macroeconomic policies should be favorable. The three indicators differ only in their specification of the observable consequences. The three indicators are

- Okun's 'Misery Index'  $M = I + U$ ,
- Calmfors' Index  $C = U - (X - M)/GDP$ ,
- the OECD's 'Magic Diamond'  $D = G_{GDP} + (X - M)/GDP - U - I$ ,

where  $I$  is the rate of inflation,  $U$  is the unemployment rate,  $(X - M)$  is the real trade balance,  $GDP$  is real gross domestic product and  $G_{GDP}$  is the rate of growth of real  $GDP$ . Okun's Misery Index and Calmfors' Index are perverse indicators of the quality of macroeconomic management, since each adds undesirable consequences. The OECD's Magic Diamond is a positive indicator, since it subtracts undesirable consequences from desirable consequences. The components of each indicator are expressed in percentage terms, and so each indicator can be compared across countries and through time without concern for exchange rate fluctuations. Each indicator can be constructed from readily available data sources, and each is frequently reported in the popular press.

However each of these indicators suffers from the same problem: by simply adding components to create an indicator, each implicitly assigns constant and equal weights to each component. This arbitrary weighting scheme does not allow for intertemporal and intercountry variation in

macroeconomic policy which, under varying economic circumstances, would tend to favor one component over another. It is therefore desirable to generalize each indicator so as to allow weights attached to each component to vary, both across countries and through time, as economic circumstances warrant.<sup>5</sup>

Our solution to the problem is to employ a linear programming technique known as data envelopment analysis (DEA) to aggregate the components of each index in a non-arbitrary fashion. A great virtue of DEA is that it permits weights attached to each component to be variable and unequal, across countries and through time. Country-year observations are allowed to select component weights which put them in the most favorable light relative to other country-year observations in the sample, subject to some restrictions to be discussed below. A second virtue of DEA is that it simultaneously constructs a best practice macroeconomic performance frontier which envelops all country-year performances from above. At the same time it measures the distance of each country-year observation to the best practice frontier, and these distances provide the basis for a ranking of country-year observations in terms of their ability to optimize each indicator.<sup>6</sup>

Suppose we observe a sample of  $i = 1, \dots, I$  countries over a span of  $t = 1, \dots, T$  years. Denote by the vector  $y = (y_1, \dots, y_M)$  a set of  $M$  desirable outcomes of macroeconomic policy, and by the vector  $x = (x_1, \dots, x_N)$  a set of  $N$  undesirable outcomes of macroeconomic policy. Then a DEA formulation of a problem intended to minimize undesirable outcomes with given desirable outcomes can be expressed as

$$\begin{aligned} \min \quad & \theta \\ & \theta, \mathcal{N} \\ \text{subject to} \quad & \theta x_n^0 \geq \sum_j \mathcal{N}_j x_n^j \quad n = 1, \dots, N \\ & \sum_j \mathcal{N}_j y_m^j \geq y_m^0 \quad m = 1, \dots, M \\ & \mathcal{N}_j \geq 0 \quad j = 1, \dots, I \cdot T \\ & \sum_j \mathcal{N}_j = 1 \end{aligned}$$

This linear program is solved  $I \cdot T$  times, once for every country-year observation in the sample. The program constructs a best practice macroeconomic performance frontier, and measures the distance of each observation from the frontier. For a country-year with data  $(y_m^0, x_n^0)$  the program seeks the maximum feasible equiproportionate contraction in its

undesirable outcomes, subject to the constraint that it does not violate best practice observed in the sample. If at optimum  $\theta = 1$ , this country-year is best practice relative to all country-years in the sample. If at optimum  $\theta < 1$ , this country-year is not best practice, and to have achieved best-practice status it would have had to decrease its undesirable outcomes to  $(100 \times \theta)$  percent of their observed values. Thus  $\theta \in (0, 1]$  provides a convenient ranking of country-year observations on the basis of their ability to minimize undesirable outcomes. Also at optimum, the nonzero elements of  $\lambda$ , identify the best practice country-year observation(s) with which the country-year being evaluated is compared. Thus high-performing country-years have two characteristics: they have optimal values of  $\theta$  at or near unity, and they appear frequently as role models for other country-years.

Since the DEA problem is a linear program, it has a dual linear program. This program can be expressed as

$$\max \sum_m v_m y_m^o + v_s$$

$$v_m, v_s, \mu_n$$

subject to

$$\sum_m v_m y_m^j - \sum_n \mu_n x_n^j + v_s \leq 0, \quad j = 1, \dots, o, \dots, I \cdot T$$

$$v_m \geq 0, \mu_n \geq 0, v_s \text{ free.}$$

For the country-year under evaluation the dual program seeks a set of nonnegative weights which, when attached to each of its outcomes, maximizes the 'value' of its desirable outcomes, subject to a normalization on the value of its undesirable outcomes and subject to a set of  $I \cdot T$  feasibility constraints. It is these feasibility constraints, together with the nonnegativity constraints, which restrict the ability of country-year observations to select large weights for their desirable outcomes and small, even negative, weights for their undesirable outcomes. Nonetheless the weights for each outcome are allowed to vary across countries and through time. Thus country-year observations are allowed to attach different values to a particular outcome as economic circumstances warrant.<sup>7</sup>

Okun's Misery Index  $M$  is a special case of the DEA problem indicated above, in which the orientation of the primal problem is toward minimizing two undesirable outcomes [ $I$  and  $U$ ] and there are no desirable outcomes. The Calmfors' Index  $C$  is a different special case of the DEA

problem, in which the orientation of the primal problem is toward minimizing the sole undesirable outcome  $U$ , with  $(X-M)/GDP$  as the sole desirable outcome. Finally the OECD Magic Diamond  $D$  is a third special case of the DEA problem, in which the orientation is toward minimizing the two undesirable outcomes [ $I$  and  $U$ ], with two desirable outcomes [ $GDP$  and  $(X-M)/GDP$ ].

Our strategy is to proceed in two stages. In the first stage we construct Okun's Misery Index  $M$ , Calmfors' Index  $C$ , and the OECD Magic Diamond  $D$ , directly from the data for various countries over a period of time. These three indicators have weights which are constant across countries and through time, and so they provide rankings of country-year observations under the constraint that all country-year observations are forced to agree that each component of the indicator is equally important. In the second stage we delete this equality constraint, by using DEA to calculate variable-weight variants of each indicator. These DEA-based indicators provide alternative rankings which allow country-year observations to attach varying degrees of importance to components as economic circumstances warrant.

We are interested in the degree of concordance of rankings based on the fixed-weight and the variable-weight performance indicators. We are also interested in the extent to which the variable-weight performance indicators vary across countries and through time, and in the extent to which the component weights themselves vary across countries and through time. Finally we are interested in how frequently a country appears as a role model for other countries. Throughout our investigation we are particularly interested in the performance of Hong Kong and Singapore.

We use a conventional data set derived from annual issues of the Statistical Yearbook for Asia and the Pacific, and various country Statistical Yearbooks. The sample countries and years are listed in Table 2.1. All of the World Bank high-performing Asian economies are represented, as are the Philippines, Australia and New Zealand, and Japan and the USA. Since not all countries report all components of the three indicators for all years, some DEA calculations of the three indicators are based on fewer than 270 observations. Since some countries report data as far back as 1964 and others report data only as far back as 1978, we report results for the common time span 1981-1993. Only Indonesia is missing the terminal year.<sup>8</sup>

A summary of the DEA-based calculations of the three variable-weight macroeconomic performance indicators appears in Table 2.2. There we report temporal means of GGDP, which can be compared with temporal



Table 2.1 Countries included in the backward-looking analysis

Australia	(1965-1993)	29
Hong Kong	(1977-1993)	17
Indonesia	(1978-1992)	15
Japan	(1964-1993)	30
Korea	(1965-1993)	29
Malaysia	(1978-1993)	16
New Zealand	(1974-1993)	20
Philippines	(1978-1994)	17
Singapore	(1966-1994)	29
Taiwan	(1965-1994)	30
Thailand	(1977-1993)	17
USA	(1975-1995)	21

means of each of the three indicators. The impressive growth rates achieved by the high performing Asian economies are apparent, ranging from over 8 percent per annum in Korea to just under 6 percent per annum in Indonesia. Singapore and Hong Kong rank fourth and sixth, both among the seven high performing Asian economies and overall.

Temporal mean values of the DEA-based Okun's Misery Index  $M$  appear in the second column of Table 2.2. Taiwan turned in the best overall performance at keeping inflation and unemployment under control, while the Philippines performed the worst. Singapore and Hong Kong ranked third and fifth, slightly better than their  $G_{DP}$  rankings. To illustrate the interpretation of these results, on average during the period Singapore would have had to reduce its inflation and unemployment rates to approximately two-thirds of their observed values in order to have achieved best practice status. Of the seven best practice observations in the sample, those to which both Singapore and Hong Kong are most frequently compared are Japan (1966) and Taiwan (1988).<sup>9</sup> Neither Singapore nor Hong Kong appears as a best practice role model for any other country-year observation during the 1981-1993 period.

Temporal mean values of the DEA-based Calmors' Index  $C$  appear in the third column of Table 2.2. Again Taiwan turned in the best overall performance, in this case in terms of its ability to minimize its inflation rate given its normalized trade balance, while Australia, the Philippines and the USA performed the worst. Hong Kong and Singapore ranked second and sixth. The interpretation for Hong Kong is that, on average during the period, and given its normalized trade balances, it could have

Table 2.2 Summary of backward-looking findings, 1981-1993

Country	[GDP Growth]	[M]	[C]	[D]
Australia	2.78	0.28	0.14	0.28
Hong Kong	6.07 (6)	0.56 (5)	0.55 (2)	0.69 (5)
Indonesia	5.88	0.50	0.46	0.58
Japan	3.61	0.76	0.45	0.77
Korea	8.24 (1)	0.51	0.36	0.53
Malaysia	6.54	0.41	0.28	0.49
New Zealand	1.52	0.32	0.20	0.34
Philippines	1.54	0.26	0.16	0.30
Singapore	7.26 (4)	0.68 (3)	0.40 (6)	0.69 (4)
Taiwan	7.71	0.84 (1)	0.70 (1)	0.93 (1)
Thailand	7.94	0.67	0.48	0.72
USA	2.56	0.34	0.16	0.34

decreased its inflation rates to 55 percent of their observed values without violating best practice observed in the sample. Of the four best practice observations in the sample, by far the most frequent role model for Hong Kong and Singapore during the period was Hong Kong (1988) itself.<sup>10</sup>

Temporal mean values of the DEA-based Magic Diamond  $D$  appear in the final column of Table 2.2. No country comes close to Taiwan. Singapore and Hong Kong rank fourth and fifth. The interpretation is that both Singapore and Hong Kong could have reduced their inflation and unemployment rates to 69 percent of their observed values on average, given their normalized trade balances and their GDP growth rates, without violating best practice observed in the sample. Of the 16 best practice observations in the sample, the role models to which Singapore and Hong Kong are most frequently compared include Taiwan (various years) and Hong Kong (1988).

The three DEA-based macroeconomic performance indicators have dual weights attached to each component. Ratios of weights indicate tradeoffs between pairs of components. We do not report detailed results for each indicator. Rather, to illustrate the variability of weights across countries and through time, we report selected results for Hong Kong and Singapore. Table 2.3 contains temporal means and ranges of the ratio of the optimal weights attached to unemployment and inflation in the two indicators ( $M$  and  $D$ ) containing both outcomes. These calculations suffice to demonstrate that optimal weights vary through time for each country, and that they also vary across countries. They indicate that both

Hong Kong and Singapore have attached greater weight to low unemployment rates than to low inflation rates as a macroeconomic policy objective. They also indicate that Hong Kong has placed greater emphasis on full employment relative to price stability than has Singapore.<sup>11</sup>

Table 2.3 Selected weighted ratio means

Misery Index Weight Ratio Means and Ranges  
( $\mu$  UNEMPLOYMENT/ $\mu$  INFLATION)

Hong Kong	6.31 (2.68-18.09)
Singapore	2.87 (0.91-4.84)

Magic Diamond Weight Ratio Means and Ranges  
( $\mu$  UNEMPLOYMENT/ $\mu$  INFLATION)

Hong Kong	18.41 (2.68-44.36)
Singapore	7.94 (0.00-17.89)

Since optimal weights attached to indicator components vary through time and across countries, we expect the DEA-based variable-weight macroeconomic performance indicators to diverge from their fixed-weight counterparts. They do, but not by as much as we had expected. We do not report detailed results for the fixed-weight versions of the three macroeconomic performance indicators. Instead, in Table 2.4 we report rank correlation coefficients between fixed-weight and variable-weight versions of each indicator. Rank correlations are positive as expected, and unexpectedly high in light of the variability of the component weights in each indicator.

Table 2.4 Rank correlations between fixed-weight and variable-weight macroeconomic performance indicators

Misery Index	0.83
Calmfors' Index	0.62
Magic Diamond	0.74

Although we have shed no light on the question of the magnitude of productivity growth in Singapore and Hong Kong, this has not been our

objective in this section. Our objective has been to evaluate the quality of macroeconomic management in the two city-states, as reflected by variable-weight versions of three popular macroeconomic performance indicators. Our analysis leads us to four backward-looking conclusions. First the quality of macroeconomic policy-making, as judged by various combinations of its observable consequences, has been substantially higher in Taiwan than in any other country in our sample. Second the macroeconomic performances of Singapore and Hong Kong rank them no better than in the middle of the group of seven high performing Asian economies. Third if Young's productivity growth calculation for Hong Kong is reasonably accurate, then Hong Kong's policy-makers have done a fairly mediocre job of converting its respectable rate of productivity growth into successful macroeconomic performance. Finally if Young's productivity growth calculation for Singapore is reasonably accurate, then Singapore's policy-makers have done a respectable job of converting its negligible rate of productivity growth into successful macroeconomic performance.

#### 4 AN ALTERNATIVE TALE OF TWO CITIES, PART II

Lee Kuan Yew, Singapore senior minister, is reported to have stated (to Krugman) that 'you're right so far, but our total factor productivity growth will be much higher in the future because of the investments we're making in education' (and other growth-enhancing areas).<sup>12</sup>

To the extent that Singapore and Hong Kong have been investing heavily in education and other growth-enhancing areas, their future productivity growth prospects may be enhanced. Our objective in this section is to take a look into the future, by conducting an evaluation of less conventional forward-looking indicators of the quality of macroeconomic management in these two countries. These indicators have as their components various measures of investment in human and physical capital which, it can be argued, ought to enhance productivity growth in the future.

Our forward-looking sample is essentially the same as our backward-looking sample: nine countries for various time periods extending back from 1993. Variables, which are taken from the same sources we used in section 3, include the share of gross domestic investment in GDP, the share of gross domestic savings in GDP, the share of health expenditure in GDP, the share of housing expenditure in GDP, the share of transport and communication expenditure in GDP, the share of education expenditure in

*Table 2.6 Selected forward-looking model results*

Country	Rank by Model (1977-1992)			
	1	2	3	4
Australia	8	4	3	8
Hong Kong	3	3	2	3
Indonesia	9	8	8	6
Korea	5	2	1	9
Malaysia	2	7	6	2
New Zealand	1	1	4	1
Philippines	6	6	5	5
Singapore	4	5	7	4
Thailand	7	9	9	7

Rankings vary across models, but when all four models are considered the overall top investor in human and physical capital has been New Zealand, followed by Hong Kong and Korea. Singapore ranks fifth. Indonesia and Thailand are at the bottom of the overall ranking.

In Table 2.7 we report somewhat more detailed results for Hong Kong and Singapore. There it is clear that Hong Kong is at or very near best practice in all four models. Singapore, on the other hand, falls well short of best practice in models 3 and 4, which include the saving rate rather than the investment rate.

From Tables 2.6 and 2.7 it is apparent that the outlook is brighter for Hong Kong with models which contain savings rather than investment (models 3 and 4), and which contain enrollments rather than educational expenditures (models 2 and 3). Although Hong Kong has had relatively high investment and savings rates (29 percent and 11 percent respectively), its saving rate has been higher relative to the rest of the sample than has its investment rate. And although Hong Kong has had relatively high enrollment ratios, its education expenditure share of GDP has been among the lowest in the sample.<sup>13</sup> Conversely, the outlook is brighter for Singapore with models which contain investment rather than savings (models 1 and 2), and which contain educational expenditure rather than enrollments (models 1 and 4). Like Hong Kong, Singapore has had high rates of investment and saving (39 percent and 12 percent respectively), but its investment rate has consistently been among the highest in the region. Unlike Hong Kong, Singapore has had relatively high rates of education expenditure, despite relatively low enrollment ratios. Singapore's low enrollment ratios have been due to the fact that it has only one university and a few colleges, and consequently many of its

GDP, high school enrollment as a percent of the population, and university enrollment as a percent of the population. We have run a number of experiments with various combinations of these measures. Some of the more interesting experiments are indicated in Table 2.5. The first two models include the share of gross domestic investment in GDP, while the second two models replace investment with savings. One of the first two models includes the share of education expenditure in GDP, and the other uses enrollment ratios. This pattern is reversed in the second two models. The shares of GDP accounted for by health, housing and transport expenditure are included in all four models. Unfortunately Japan, Taiwan and the USA are excluded from the analysis because they do not report comparable data.

*Table 2.5 Variables included in selected forward-looking models*

Outputs	Models			
	1	2	3	4
Investment as % of GDP	x	x	x	x
Savings as % of GDP				
Health Expenditure as % of GDP	x	x	x	x
Housing Expenditure as % of GDP	x	x	x	x
Transport Expenditure as % of GDP	x	x	x	x
Education Expenditure as % of GDP	x			x
HS Enrollment as % of Population		x	x	
Univ Enrollment as % of Population		x	x	

Our strategy is to use a variant of the generic DEA model introduced in section 3 to evaluate the propensity of sample country-year observations to undertake the productivity-enhancing investments in human and physical capital indicated in each of the models. Thus we report the results of four DEA models. The orientation of each model is toward maximizing the investment variables, which are treated as desirable outputs. There are no inputs in these models. We use data covering different time periods for different countries in the DEA exercises, but to enhance comparability we report results for the 1977-1992 time period common to all countries. Results are summarized in Table 2.6, where we report rankings based on temporal mean performances.

students are trained overseas.

Table 2.7 Detailed forward-looking results for Hong Kong and Singapore

Model	Country		Winner
	Hong Kong	Singapore	
1	0.89	0.89	0.96
2	0.96	0.90	0.99
3	0.96	0.78	0.96
4	0.91	0.80	0.94

It is possible that the results reported in Tables 2.6 and 2.7 overstate Singapore's future growth potential. This is because Singapore allocates a relatively large share of GDP to investment in housing (1.8 percent on average during the period), and this share exceeds the shares it allocates to health and transport. While it is plausible that investment in health, transport and education will enhance future growth prospects, it is less likely that investment in housing will do likewise. While it will certainly enhance living standards, the opportunity cost of housing investment in Singapore may be high.

## 5 SUMMARY AND CONCLUSIONS

This study originated in deep skepticism of the revisionist claim of unimpressive rates of productivity growth in East Asia in general, and in Singapore in particular. Our skepticism remains, despite the fact that we have no alternative estimates of productivity growth to offer. We have, however, formed some impressions of the past performance and the future prospects for Singapore and Hong Kong. Our impressions are based on a series of backward-looking and forward-looking evaluations of the quality of macroeconomic management in these two economies. Since management quality is not directly observable, we base our two sets of evaluations on observable consequences of economic policies.

Our backward-looking evaluations were based on variable-weight versions of three conventional indicators of macroeconomic performance: Okun's Misery Index, Calmfors' Index and the OECD Magic Diamond. We found Hong Kong and Singapore to rank no better than in the middle of the seven high performing Asian economies, well behind Taiwan. That

Singapore managed to achieve its success despite the apparent absence of productivity growth is impressive. It is also noteworthy that the seven high performing Asian economies outperformed the USA, Australia and New Zealand, typically by wide margins.

Our forward-looking evaluations were based on various combinations of investments in human and physical capital, since such investments should pave the way for future economic success. On these criteria Hong Kong ranked second behind New Zealand, and Singapore ranked fifth. To the extent that past investments do augur well for future economic success, and subject to the current uncertainties surrounding Hong Kong's reversion to Chinese sovereignty, the future looks bright for Hong Kong.

The data on which this study is based extend only through 1994, but the tumultuous events of 1997 are still reverberating throughout the region. Can the results of this study shed any light on 1997? It is clear that 1997 was not about productivity growth, but about the quality of macroeconomic management. Thus even though our notions of the quality of macroeconomic management do not include indicators of the quality of the financial infrastructure, or of the opaque linkages between the financial sector and business and government, it is perhaps worth revisiting our findings in light of 1997. We gave the highest backward-looking marks to Taiwan, which has weathered the storm in relatively good economic shape. We gave above average marks to Hong Kong and Singapore, both of which have done likewise. We gave below average marks to Indonesia, Korea, Malaysia and the Philippines, all of which have suffered greatly. Only Thailand, which started the financial difficulties, received relatively high backward-looking marks, and it received poor forward-looking marks. There thus appears to be a degree of concordance between the quality of macroeconomic management as we have defined it and performance during and immediately after 1997.

## NOTES

1. Hong Kong reverted to the sovereignty of China on 1 July 1997, and the impact this reversion has on Hong Kong's economic future is uncertain. Although we do not speculate in this chapter, Gapinski and Western (1998) do.
2. The World Economic Forum and the International Institute for Management Development studies are discussed in *The Economist* (1996b).
3. As reported in *The Economist* (1996a).
4. As reported in *The Economist* (1997a).
5. This observation was apparently first made by Melyn and Moesen (1991).
6. DEA was introduced by Charnes *et al.* (1978). A good recent reference is

Charnes *et al.* (1994).

7. The analogy to the revealed preference approach to demand analysis should be apparent; in this formulation country-years reveal their preferences for components of indicators. We owe this point to Kevin Fox.
8. Several country-year observations have negative values of one or more of the components of each indicator. This presents no difficulty in calculating fixed-weight versions of the three indicators, but it does present a problem in calculating the DEA-based variable-weight versions of the three indicators. We have therefore translated each component by adding to every country-year value the smallest value observed in the sample to assure that all values of each component are nonnegative. Lovell and Pastor (1995) have shown that under certain conditions, satisfied here, DEA is invariant to such a translation of variables.
9. Japan (1966) had  $U = 0.9$  and  $I = 5.1$ , while Taiwan (1988) had  $U = 1.7$  and  $I = 1.28$ ; these two observations served as joint role models for the majority of the remaining observations.
10. Hong Kong (1988) had  $(X - M)/GDP = 0.07$  and  $U = 1.1$ , and served as the sole role model for the majority of the remaining observations.
11. As evidence of this greater emphasis, during the period Hong Kong's mean unemployment rate was 2.45 percent, while Singapore was 3.17 percent. The tradeoff Hong Kong experienced was a higher mean rate of inflation, 10.03 percent compared with 4.35 percent in Singapore.
12. The quote is taken from *The Wall Street Journal* (1995). The parenthetical phrase is ours.
13. *Business Week* (1997) notes that 85 percent of Hong Kong's primary school students attend school part time because of insufficient investment in schools. Thus the popular view that throwing money at existing schools may be unproductive may not apply to Hong Kong, where investments in new schools may be very productive.

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