Convergence, Catch-up and Growth Sustainability in Asia: Some Pitfalls

JESUS FELIPE

ABSTRACT   *This paper takes a sample of 16 Asian countries and shows that: (i) Income levels in Asia have not tended to converge during the last 30 years, (ii) There has not been a catch-up process with the US: the initially more advanced Asian countries have reduced the income gap with the US faster. (iii) The catch-up variable does not explain labour productivity growth in Asia. The most important explanatory variables are the growth of demand and the level of human capital. (iv) The amount of time it will take most Asian countries to catch up with the US in terms of per capita income, under reasonable assumptions, is so long that the notion that Asia is almost, or soon will be, wholly on its own and join the ranks of (or more likely will compete with) the developed economies should be dispelled. Only a technological revolution, which would allow the developing countries to "jump" above and beyond today's developed nations, would reverse the situation. This, however, does not seem to be a realistic scenario. (v) The effect of the recent financial crisis in East and Southeast Asia will be to "lose" at least one decade in the development race.*

> We have to admit, in all humility, that the so-called East Asian miracle is far from the ideal. Complacency on our part would be disastrous. We have to be realistic enough not to assume that it is sustainable only because we have done so far for the past thirty years.
>
> (Anwar Ibrahim, ex-Deputy Prime Minister, Malaysia)

1. Introduction

In a recent essay, Radelet & Sachs (1997) drew attention to the fact that Asia's share of world income has been rising for three decades, and predicted that after the financial crisis Asia will reemerge and become the centre of economic activity (as measured by its output share) in the world, just as it was before the 1500s. While it might be true that Asia will recover from the current crisis within a few years, it is far more problematic to argue that Asia will reemerge as the world's centre of economic activity by the early 21st Century.

The problem goes to the heart of modern growth economics by raising the issues of convergence and catch up between the less developed and the developed economies of

Jesus Felipe, Georgia Institute of Technology, Atlanta, GA 30332-0610, USA.

the world over time. More broadly, it also poses the problem of interpreting in a broader sense what being the "world's centre of economic activity" really means.[1] The recent currency crises have given rise to speculation about the end of the Asian miracle. The turmoil does show the fragility of the financial systems in the affected countries. This, combined with pegged exchange rates and export slowdowns, led to a sudden collapse of confidence and to widespread financial disruption. In some of the affected countries such as Indonesia, Korea and Thailand, this has certainly meant a loss of output in the short run. It is possible for these countries to pull out of this crisis; but for long-run growth, especially if growth is to be reflected in an increase in the quality of life of the people in a broad sense, much institutional restructuring will be necessary. How fast these institutional changes can occur and how far they can go will determine the quantitative and qualitative dimensions of Asian growth in the future.

Even before the currency and financial crises, debate about the East Asian countries centred on the question of whether they will be able to keep up their spectacular performance. Scholars and policy-makers wanted to know whether and/or how long the bonanza would continue. The important achievements of the countries in the region have led some people to believe that the miracle has been accomplished, and that Asia soon will be wholly on its own and join the ranks of (or more likely will compete with) the OECD economies. Likewise, there is a widespread belief in some circles that the growth episode in the region has been accompanied by two processes: one of convergence within the region and another one of catch up, whereby less productive nations are reducing the gap with the most productive ones. This would be the result of the linkages established in the region through trade and investment which result in fast economic growth that promotes economic integration; and vice versa, economic integration hastens convergence and catch up.

The purpose of this paper is to gain insight into these issues. I put forward the thesis that while the East Asian miracle is a hard fact (in the sense that the per capita income of the countries in the region grew phenomenally during the past), by no means does this imply that Asia will be the world's centre of economic activity by the first quarter of the next century. The reason is that despite the growth of the recent past, incomes per capita within the region have not shown a converging trend, and are not catching up with that of the US. It is one thing is to argue that Japan has caught up or greatly reduced its gap with the US., another to argue that the region (however narrowly defined) shows clear signs of a catch-up process. Furthermore, under reasonable assumptions, I show that it will take a long time for most countries in Asia to catch up with the US's, living standards. And given the impact of the financial crisis, the period will be lengthened for most East Asian countries.

I ask, in particular, the following specific questions in the context of the debate about growth in Asia:

(1) Have incomes tended to converge within Asia during the last 30 years?
(2) Have Asian incomes tended to catch up with that of the US?
(3) What annual growth rates of per capita income will the countries in the region have to achieve if they want to have the same per capita income as the US within a given number of years?
(4) What will be the impact of the financial crises in terms of catching up?

The sample of countries considered includes Japan, Singapore, Taiwan, Korea, Hong Kong, Indonesia, Malaysia, Thailand, Bangladesh, China, India, Myanmar, Nepal, Pakistan, the Philippines and Sri Lanka. This is a diverse group that covers a wide geographic area in Asia, as well as countries at all levels of development. The period is
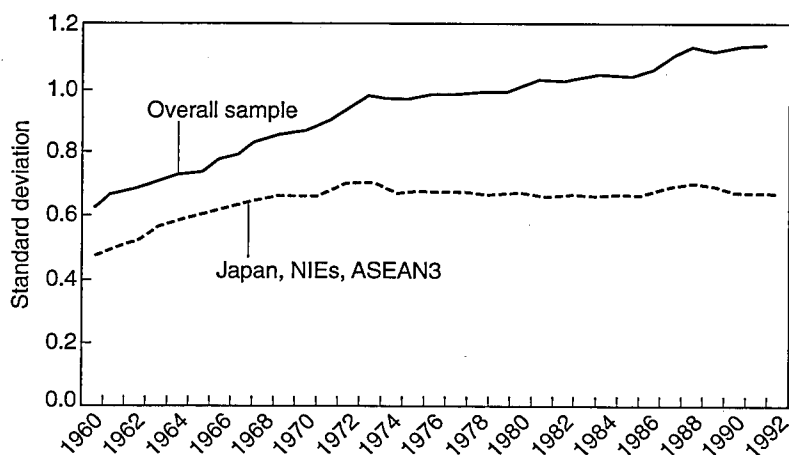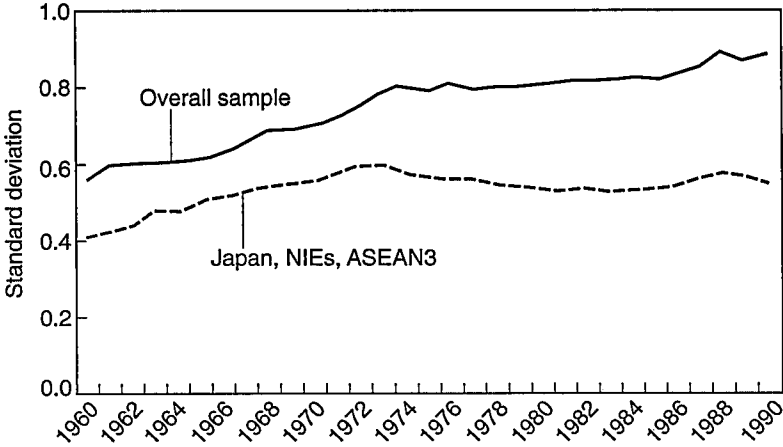
Figure 1. Income per capita: sigma convergence.

1960–92. Data on output and the share of investment in output are from the Penn World Tables, downloaded from the web site of the University of Pennsylvania. Human capital is from the STARS database of the World Bank. The rest of the paper is structured as follows. In Section 2, I test the hypothesis of absolute convergence among the group of Asian countries, using the notions of σ and β convergence. In Section 3, first I discuss the notion of catch up in a Kaldor–Gomulka framework. Second, I perform a simple textbook exercise and estimate the number of years it will take the Asian countries to catch up with the US in terms of per capita income. In Section 4, I evaluate the impact of the financial crises on the three countries that have been most badly affected, requesting assistance from the International Monetary Fund, namely, Indonesia, Korea and Thailand. The conclusions are in Section 5.[2]

2. Convergence or Divergence in Asia?

Barro & Sala-i-Martin (1992), studying the phenomenon of convergence, introduced two notions.[3] σ-convergence refers to a reduction in the cross-sectional variance of income per capita (or per worker) among a group of countries. β-convergence, on the other hand, refers to an inverse relation between the growth rate of income and its initial level; hence poorer countries grow faster than rich ones.[4] Figures 1 and 2 plot the evolution of σ-convergence for the sample of 16 Asian countries considered, and for eight high-performing economies, namely, Japan, the NIEs (Hong Kong, Taiwan, Korea, Singapore) and the ASEAN3 (Malaysia, Thailand, Indonesia), for both income per capita and income per worker. The graphs do suggest that incomes throughout Asia are becoming more rather than less dispersed around the mean. For the whole group the measure displays a clear upward trend in both cases. The σ-convergence measure for the eight high-performing economies indicated an increasing discrepancy until around 1973, after which it declined slightly. Since then it has been approximately constant, and certainly it does not show a downward trend.[5]

These considerations appear to be supported by the measurement of β-convergence, reflecting the tendency of countries with relatively low initial levels of output per capita to grow relatively faster. The test for β-convergence consists on a regression of the growth rate of output per capita (per worker) for the period 1960–92 (1960–90) on the

Figure 2. Income per worker: sigma convergence.

level of output per capita (per worker) in 1960, i.e. the initial level.[6] The hypothesis of convergence would be empirically supported if the parameter of the initial income variable (β) turns out to be negative, indicating that countries with a lower initial level grew faster during the period considered. On the other hand, a positive sign would indicate that initially richer richer countries grew faster, contrary to the notion of convergence.

The results are shown in Table 1. $\Delta\ln$ (Y/L_i) is the annual growth rate of income per capita (or per worker) for the period 1960–92. The subscript i refers to the country, ln (Y/L_i) is the level of income per capita (in logarithms) in 1960 for each country. For the complete sample, the regression displays a positive sign; for both per worker and per capita incomes. These positive (and statistically significant) coefficients indicate divergence in income for the period considered. For the high-performing economies the parameter is not different from zero; this is also the case for output per capita and output per worker, indicating that the hypothesis of lack of convergence ($\beta = 0$) is not rejected.

These results indicate that disparities among rich and poor countries in Asia have not shown a tendency to diminish during the last three decades, not even among the eight high-performing countries. Why has there been no tendency towards convergence? In the standard neoclassical model, countries should converge to the same level of economic development provided economic agents in every country are endowed with the same tastes and benefit from the same access to technology. Thus,

Table 1. Absolute convergence regressions, $\Delta\ln \left(\dfrac{Y}{L}\right)_i = \alpha + \beta \ln \left(\dfrac{Y}{L}\right)_i^{1960}$

	Per capita			Per worker		
	β	t-stat	R^2	β	t-stat	R^2
Overall sample	0.178	2.09	0.24	0.0122	1.85	0.196
High-performing	0.003	0.32	0.017	0.005	0.66	0.068

Overall sample: Japan, Singapore, Taiwan, Korea, Hong Kong, Indonesia, Malaysia, Thailand, Bangladesh, China, India, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka. High-performing economies: Japan, Singapore, Taiwan, Korea, Hong Kong, Indonesia, Malaysia, Thailand.

within this framework there is no room for a divergent process of growth of output and output per capita among countries. Other models, however, reach the opposite conclusion, and allow for diverging growth rates under some conditions (Dixon & Thirlwall, 1975). Kuznets (1971) indicated that there are institutional and ideological factors that affect growth, and Abramovitz (1986) referred to the "social capabilities" that permit successful exploitation of technologies imported from the leaders.[7] We need more understanding of how these factors come into play. Countries make choices in terms of policies and institutions. Bad choices often prevent economies from acquiring the capacities needed to exploit whatever advantages they might possess.

Another possible reason is that certain economies may be handicapped by factors such as location, climate, or any other physical circumstance not amenable to easy changes that push the economy towards a poverty trap. Therefore, although integration of the world economy sets strong forces in motion that push the economies in the direction of convergence, there seem to be other forces operating in the opposite direction, which pull the system apart.

3. Catching up: Meaning and Implications

3.1 The Catch-up Pitfall

There is a widespread belief that a catching-up phenomenon, reducing the gap between leader and followers, is at work. What is this mechanism? Gerschenkron (1962) argued that development required certain prerequisites on top of government policies, but that there were forces which, in the absence of such prerequisites, could operate as substitutes. In particular, he hypothesized that the more backward a country, the more rapid will be its industrialization. He called this the "advantage of economic backwardness". Likewise, in the neoclassical framework, low-capital countries should catch up to the level of the developed countries because: (i) higher interest rates should induce higher domestic savings; (ii) higher rates should attract foreign investment; and (iii) the marginal productivity of a unit of invested capital is higher. What is the force behind this mechanism? Technological spillovers from the advanced to the backward countries, mainly via international trade and foreign direct investment. The idea is best explained in the following terms:

> When a leader discards old stock and replaces it, the accompanying productivity increase is governed and limited by the advance of knowledge between the time when the old capital was installed and the time it is replaced. Those who are behind, however, have the potential to make a larger leap. New capital can embody the frontier of knowledge, but the capital it replaces was technologically superannuated. So, the larger the technological and, therefore, the productivity gap between leader and follower, the stronger the follower's potential for growth in productivity; and, other things being equal, the faster one expects the follower's growth rate to be. Followers tend to catch up faster if they are initially more backward.
>
> (Abramovitz, 1986, pp. 386–387)

Evidence shows that these mechanisms operated in the post World War II period, and that they permitted Europe and Japan to catch up to the US level (Baumol, 1986). The problem is that the idea of catch up due to spillovers appears to take place automatically. In practice this seems to be incorrect (Hobday, 1995; Freeman & Soete, 1997).

The reason is that assimilating technology is not an automatic process, but a rather long and complex one.

In this section I ask whether there is empirical evidence of catch up between the Asian countries and the US, using Verspagen's (1991) catch-up non-linear equation:

$$g = a_1 + a_2 \, Ge^{[a_3 \, (G/H)]} + a_4 \, H \tag{1}$$

where G is the technological gap with the US at the beginning of the period considered, defined as $G = 1 - (Y_i/Y_{US})$.[8] Y_i and Y_{US} are the levels of income per worker at the beginning of the period in the country and in the US, respectively. Defined this way, $0 \le G \le 1$ (provided $Y_i \le Y_{US}$). $G = 0$ means that the country in question has the same income as the US, while higher values of G imply that a country is relatively poorer. The annual rate of growth (for the period) by which the technological gap is closed is given by g (a positive g implies that the country is getting poorer with respect to the US, a negative value indicates that the country is closing the gap); e is the exponential number. The appearance of e implies that the more backward a country is, the more difficult it is to benefit from the various knowledge spillovers that are supposed to be instrumental in catching up. This effect is lessened by H, which represents the intrinsic learning capability, akin to Abramovitz's social capability. The variable H is proxied by the average level of human capital of the working population (total number of years of schooling). The larger this intrinsic capability then the smaller the technological distance effect.

Equation (1) indicates that, for a given intrinsic learning capability, there is a threshold value of the technology gap above which no catch up is possible. Evidence in favour of the catch-up hypothesis would be if $\hat{a}_2 < 0$, $\hat{a}_3 < 0$, $\hat{a}_4 < 0$, indicating that the countries with the larger initial gap with the US are the ones closing it faster (in this framework closing the technological gap means reducing the value of G, i.e. $g < 0$). Analysis is conducted for the overall sample of 16 Asian countries, as well as the two subsamples for the eight high-performing economies, and the smaller one for the four NIEs plus Japan. Annual growth rates have been calculated for the subperiods 1960–65, 1965–70, 1970–75, 1975–80, 1980–85 and 1985–92. Table 2 shows the results of the estimation of equation (1). The three relevant coefficients have positive signs, and for the first two subsamples a_2 is even statistically significant, indicating that the richer countries at the beginning of the subperiods were the ones that closed the gap with the US faster. This is precisely what Figures 3–5 show. They dissipate any notion of catch up. These graphs (for each subsample) show that the countries with the highest G at the beginning of the period, i.e. the poorer ones relative to the US, are not closing the gap ($g > 0$) and thus are becoming poorer relative to the US. On the other hand, the richer countries at the beginning of the period (i.e. those with the lower G) are the ones closing the gap ($g < 0$).

The non-linear part of the equation, coefficient a_3, turns out to be statistically insignificant, the same as the intrinsic learning capability.[9] A significant result is that this also occurs for the eight high-performing economies (second regression, Figure 4); for the Japan and NIEs subsample (third regression, Figure 5), the estimated parameters are statistically insignificant. All this evidence indicates that the idea that East Asia is catching up with the US is fallacious.

Why is Asia failing to catch up? One possible reason is that there are mechanisms that make developed countries accrue systematically most benefits of technical progress (to begin with, they are the producers of technology), and which make the diffusion of technology a difficult process. Likewise, there are international arrangements governing the flows of goods and capital. Finally, the specific conditions in some of the follower
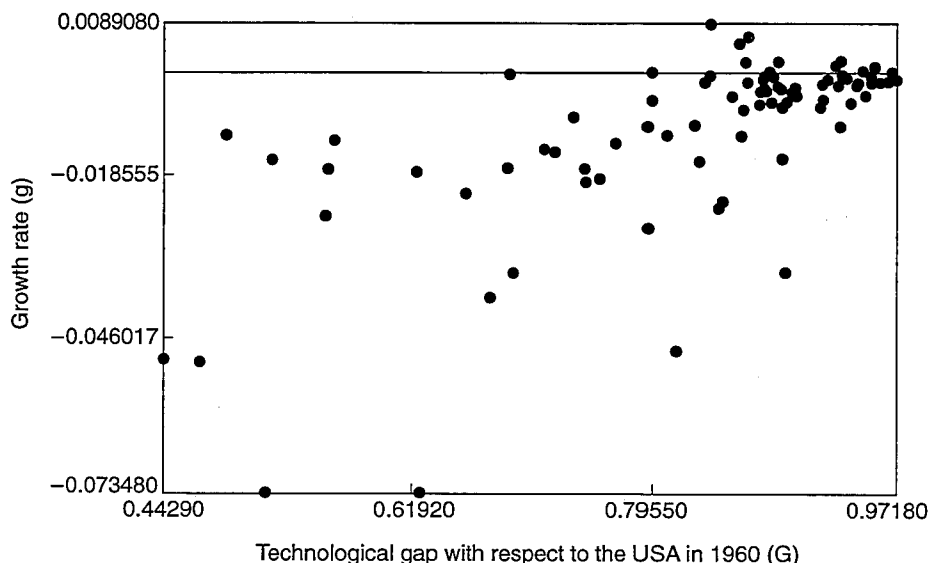
Figure 3. Initial gap with the US and its growth rate: overall sample. Note: In Figures 3–5 the axes are scaled to show the lowest and highest values, with two intermediate points being taken to divide the scale into three equal portions.

countries (i.e. their social capabilities) may not help them. Nevertheless, this conclusion has to be qualified. Surely Japan, Singapore, Taiwan, Korea, Hong Kong, Malaysia, etc. have each reduced their gaps with the US during the last 30 years; but when all this is formulated in terms .of the catch-up hypothesis (i.e. have the laggards reduced the gap faster?), it is rejected.[10] For this reason it is important to distinguish between *individual catch up*, which applies to a large number of countries, and *group catch up*,
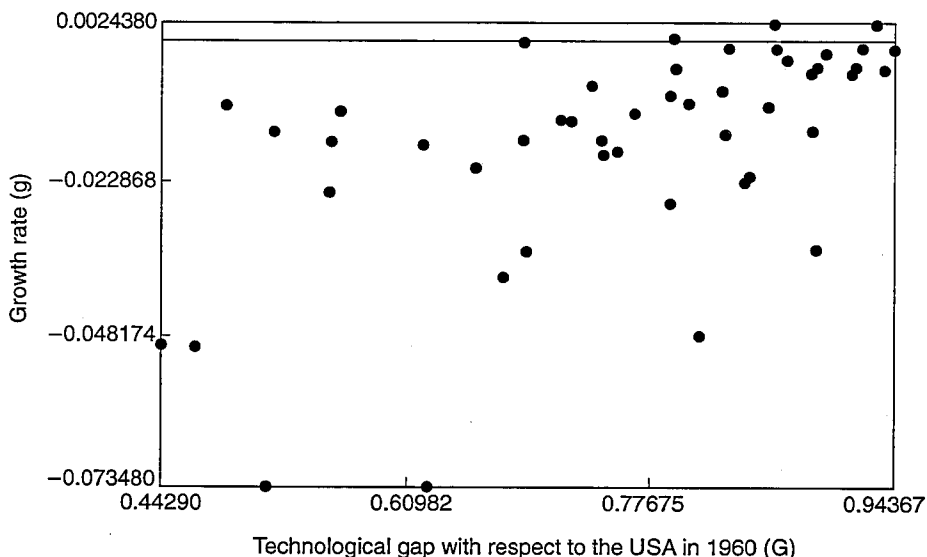
Figure 4. Initial gap with the US and its growth rate: Japan, NIEs, ASEAN3.
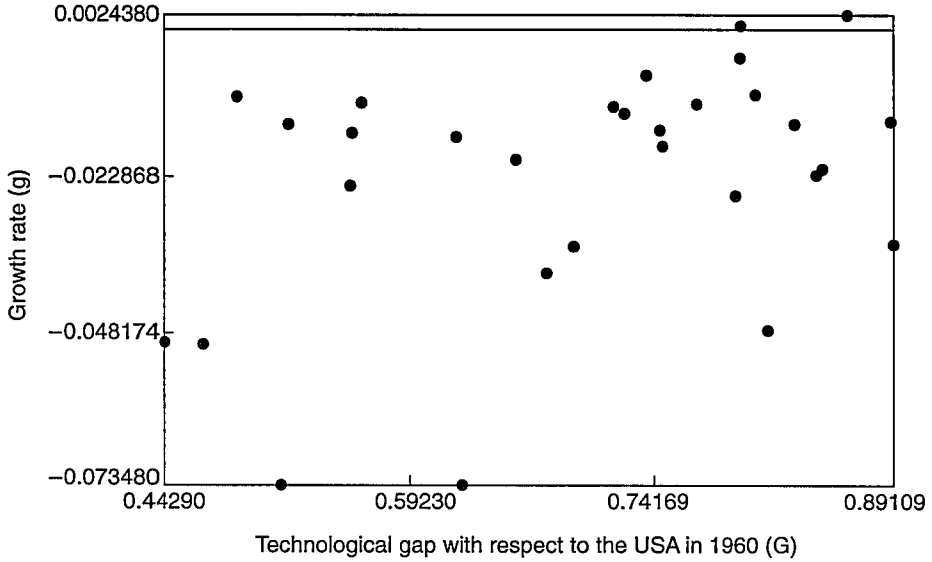
Figure 5. Initial gap with the US and its growth rate: Japan, NIEs.

which applies to a reduced number of countries, a phenomenon affecting almost exclusively the developed world.

To test further the catch-up effect in Asia I have estimated a simple growth model of Kaldorian lines. Kaldor hypothesized that the growth rate of labour productivity (y) of a country is determined by the growth rate of output (q). This is the so-called Verdoorn Law (Kaldor, 1966), which Kaldor interpreted as empirical evidence in favour of the existence of dynamic economies of scale. In Kaldor's view, demand growth facilitated the reallocation of employment towards more productive sectors and speeded up the introduction of innovations in these sectors. Capital-embodied technology also plays an important role in catching up. In fact, the share of equipment investment in total output (I/Q) appears to be one of the most important variables influencing productivity growth. Finally, the level of human capital (H) is included as a regressor. Therefore, the equation specified is

$$ y = a_1 + a_2\,q + a_3\,G + a_4\,H + a_5\,I/Q. \tag{2} $$

Table 2. Non-linear catch-up regressions; equation (1)

a_1	a_2	a_3	a_4	
− 0.0864	0.0865	0.068	0.0008	$R^2 = 0.47$
(− 4.41)	(4.41)	(0.79)	(0.87)	$N = 96$
− 0.076	0.063	0.50	0.001	$R^2 = 0.33$
(− 3.06)	(2.40)	(1.49)	(0.90)	$N = 48$
− 0.07	0.028	2.45	0.0002	$R^2 = 0.22$
(− 2.06)	(0.88)	(1.25)	(1.27)	$N = 30$

Equation (1): overall sample; equation (2): Japan, Korea, Hong Kong, Taiwan, Singapore, Malaysia, Thailand, Indonesia; equation (3): Japan, Korea, Hong Kong, Taiwan, Singapore. t-Statistics in parentheses.

Estimation: non-linear least squares (adjusted White's heteroscedasticity consistent standard errors). t-Statistics in parentheses.

Table 3. Growth and catch up in Asia; equation (2)

a_1	a_2	a_3	a_4	a_5	
− 0.013	0.596	0.0058	0.00078	0.036	$R^2 = 0.84$
(− 0.73)	(5.33)	(0.35)	(0.84)	(1.50)	$N = 96$
− 0.027	0.666	0.0189	0.0022	0.008	$R^2 = 0.84$
(− 1.45)	(4.62)	(0.95)	(2.56)	(0.23)	$N = 48$
− 0.033	0.686	0.026	0.002	0.0128	$R^2 = 0.85$
(− 1.50)	(1.27)	(0.39)	(1.63)	(0.23)	$N = 30$

Equation (1) (first row): overall sample (16 countries); equation (2) (second row): Japan, Korea, Hong Kong, Taiwan, Singapore, Malaysia, Thailand, Indonesia; equation (3) (third row): Japan, Korea, Hong Kong, Taiwan, Talwan, Singapore.

y and q are annual growth rates for the subperiods 1960–65, 1965–70, 1970–75, 1975–80, 1980–85, 1985–92 of real GDP per worker and real GDP, respectively; G is the technological gap with the US at the beginning of each subperiod (as defined in the text); H is the level of human capital (average number of years of total schooling of the working population) at the beginning of each subperiod; I/Q is the share of real investment in output at the beginning of each subperiod.

Estimation: TSLS (adjusted White's heteroscedasticity consistent standard errors). t-statistics in parentheses.

Estimation results are shown in Table 3 for the overall sample (16 countries), the high-performing economies (eight countries) and the more advanced group (five countries).[11] The following aspects are worth pointing out:[12] (i) the catch-up variable (G) is insignificant, both in the whole sample and in the two subsamples; (ii) the share of investment in output (I/Q) is also consistently insignificant (marginally significant for the overall sample); (iii) the level of human capital (H) appears to be significant only in the last two subsamples; and (iv) the most important variable is the growth of output (q). The coefficients obtained are in the range that Kaldor hypothesized, i.e. $0 < a_2 < 1$. This result implies that the expansion of production opens the way to more rationalization. Dynamic economies of scale, therefore, are a crucial factor in explaining growth in Asia; *ceteris paribus*, a growth rate of output of 5% will induce a growth rate in labour productivity of around 2.5%.

Finally, to avoid the problem that the growth rate of labour productivity (y) is definitionally equal to ($q - l$), where l is the growth of employment (since q appears on both sides, this will impart a spurious correlation between y and q), the growth of employment l was used as the left-hand-side variable (see McCombie & Thirlwall, 1994, Chapter 2). The results are robust to this change in specification, with the coefficient of the growth of output (q) becoming ($1-a_2$). The estimated coefficient ($1-a_2$) (t-statistics in parentheses) in each of the three regressions is equation (1): 0.403 (3.04); equation (2): 0.333 (1.94); equation (3): 0.313 (0.50).

3.2 How Much does Growth Matter? A Simple Textbook Exercise

In the light of the results given it is interesting to ask the following questions: (i) *How long* will it take the Asian countries to catch up to the US level (in per capita income in PPP terms)? (ii) *What is the annual growth rate* that the Asian countries have to achieve if they want to catch up with the US in per capita income and is this growth rate a feasible one?[13] Most countries in the region have, in one way or another, indicated that they have targets: Malaysia, the "Vision 2020" programme to become an industrialized nation; the "Philippines 2000" to become a NIE; the Peoples' Republic

of China has set itself the target that by 2000 its major industries should reach the technological levels attained by the advanced countries in the 1980s; and that by the year 2020 it should join the ranks of the mid-level developed nations. The framework to answer these questions is given by the following relationship:

$$Y_{0;US} \, e^{(r_{US}t)} = Y_{0;i} \, e^{(r_i t)} \tag{3}$$

where $Y_{0;US}$ is the initial income per capita of the US and $Y_{0;i}$ the initial income per capita of the Asian country (both known); r_{US} and r_i are the annual growth rates of the US and the Asian country, respectively; and t denotes time. Thus, given $Y_{0;US}$ and r_{US}, we can estimate the time t it will take the Asian country to catch up with the US for different growth rates r_i. Alternatively, we can estimate the required growth rate r_i for the Asian country to catch up with the US in a given year t given the US growth rate r_{US}.[14] The calculations assume that per capita income in the US will grow at an annual rate of $r_{US} = 1.75\%$.[15] The starting year Y_0 is 1992, the latest available year in the Penn World Table Mark 5.6. The results are shown in Tables 4 (time to catch up) and 5 (required growth rate to catch up in a given year). I must stress that these figures are not a forecast of the countries' growth rates. They show how fast the countries *need to grow* to achieve the target and do not have any policy implications in themselves—but they do carry information and can be used to judge the validity of certain policies and targets. It must also be remembered that, given the length of the periods considered, per capita incomes are not strictly comparable due to structural changes in the economy (e.g. we do not know the basket of goods and services that will be available in the year 2100; just compare the ones available in 1900 and today).

With these caveats in mind, probably the best reference point in order to understand what these figures imply is to compare them with the growth rates the countries achieved in the past (Table 6). For example, Indonesia's annual per capita income growth rate for the period 1960–92 was 4.44%, Malaysia's was 4.47% and Korea registered 6.88%. The highest growth rates achieved by the region were probably almost 8% by Korea, and slightly above 8% by Japan, but only for one decade, Korea during the 1980s and Japan during the 1960s. These are the figures that have elevated the countries in the region to the status of "miracles". If similar figures were to be achieved during the next 30 years, their performance would become a hyper-miracle. What do the figures in Tables 4 and 5 indicate? With the exceptions of Hong Kong, Singapore, Taiwan and Korea, which will most probably catch up some time during the first quarter of the next century (the first two during this coming decade), the rest of the countries in the region will have to wait longer.

The cases of Singapore and Hong Kong are special due to their status as cities. Hamburg, the richest city in Europe, has an income 60% above that of the US average, while Germany as a whole has an income some 20% below that of the US. To appreciate the importance of the effects of compounded growth rates note, for example, that for Singapore, which has virtually caught up with the US, a reduction in the per capita income growth rate from 4 to 2% would send the catching-up year back 100 years.[16] On the other hand, the prospects for catching up for most countries in the region, especially in South Asia and Indochina, are rather gloomy. The required growth rates for these countries are unrealistic. The following quotation reflects the state of Bangladesh:

> It is estimated that over 40 percent of the population regularly consume less than the absolute critical minimum of 1800 calories per day. These 50 million people are amongst the world's poorest by any standard of development.

Table 4. The year to catch up with the US

Country	Growth rate of per capita income (%)					
	2	3	4	5	6	7
NIEs						
Hong Kong	2027	1999	1996	1995	1994	1994
Korea	2332	2060	2030	2018	2012	2009
Singapore	2134	2021	2008	2003	2001	1999
Taiwan	2273	2049	2024	2014	2009	2006
China	3005	2196	2106	2071	2053	2041
Mongolia	2886	2172	2092	2062	2046	2036
Southeast Asia						
Indonesia	2866	2168	2090	2060	2044	2035
Malaysia	2456	2085	2044	2028	2020	2015
Philippines	2955	2186	2100	2067	2050	2039
Thailand	2610	2116	2061	2040	2029	2022
Indochina						
Lao PDR	3034	2201	2109	2073	2055	2043
Myanmar	3300	2255	2139	2094	2070	2055
South Asia						
Bangladesh	3001	2195	2105	2071	2052	2041
Bhutan	3300	2255	2139	2094	2070	2056
India	3067	2208	2113	2076	2056	2044
Nepal	3165	2228	2124	2084	2062	2049
Pakistan	3022	2199	2108	2072	2054	2042
Sri Lanka	2845	2163	2088	2059	2043	2034

Notes: US per capita income growth rate was set at 1.75%. Mongolia, Lao PDR and Bhutan were not included in the analysis in Section 2 due to lack of historical data. Author's calculations.

Furthermore, others have estimated that the numbers of absolute poor have risen significantly. The poverty of these deprived people is deep rooted, pervasive and multi-faceted, relating not just to the absence of reliable incomes and productive assets, but also to food, safe water, sanitation, education, shelter, inequalities, injustice and lack of power. These most deprived persons of the world are also extremely vulnerable to disaster and disease. The challenges posed by this mass of poverty are enormous for a country which is now populated in total by over 120 million, on a land base which is already the most densely in the world at over 800 persons per sq. km., with accelerating environmental degradation.

(NEMAP, 1995, p. 18)

The task is formidable even for Malaysia, since in order to catch up with the US in 2025, it would need to maintain a growth rate of income per capita even higher than that achieved during the previous 30 years (5.32% versus 4.47%). A growth rate of around 4.5% would allow Malaysia to catch up some time between 2025 and 2050. However, I must stress that this would entail the achievement of growth rates similar to those in the past for another 30 years. A country growing at an annual rate of 4.5% for 60 years would multiply its per capita income by an astonishing factor of fifteen. The *Economist* 1 March 1997, p. 25) predicted that the original tigers are likely to see

Table 5. Per capita income growth rates necessary to catch up with the US in a given year (in per cent)

Country	Year to catch up					
	2005	2025	2050	2075	2100	2200
NIEs						
Hong Kong	2.42	2.01	1.90	1.86	1.83	1.79
Korea	8.48	4.35	3.22	2.78	2.54	2.16
Singapore	4.52	2.83	2.36	2.18	2.08	1.92
Taiwan	7.30	3.90	2.97	2.60	2.40	2.09
China	23.20	9.71	6.21	4.84	4.12	2.97
Mongolia	20.46	8.75	5.67	4.48	3.84	2.83
Southeast Asia						
Indonesia	20.00	8.58	5.58	4.41	3.79	2.80
Malaysia	11.07	5.32	3.77	3.16	2.83	2.31
Philippines	22.03	9.30	5.98	4.69	4.00	2.91
Thailand	14.33	6.53	4.44	3.63	3.19	2.49
Indochina						
Lao PDR	23.88	9.95	6.34	4.93	4.19	3.01
Myanmar	30.24	12.14	7.54	5.76	4.82	3.33
South Asia						
Bangladesh	23.09	9.68	6.19	4.83	4.11	2.97
Bhutan	30.24	12.14	7.54	5.76	4.82	3.33
India	24.65	10.22	6.49	5.04	4.27	3.05
Nepal	26.96	11.02	6.93	5.34	4.50	3.17
Pakistan	23.59	9.85	6.28	4.90	4.16	2.99
Sri Lanka	19.52	8.41	5.49	4.35	3.74	2.78

Notes: US per capita income growth rate was set at 1.75%.
Author's calculations.

growth slow to an average of 5–6% over the next decade. China, Malaysia, Thailand and Indonesia, on the other hand, should be able to grow by 7–8% over the next 10 years.[17]

From these growth rates, we have to subtract one to two percentage points for population growth—and growth rates will probably decline afterwards, thus pushing the catching-up year further away. Therefore, except for the four tigers, and maybe Malaysia, the rest of the countries in the region should not expect to catch up with US in terms of per capita income until at least the second half of the 21st Century. Therefore, for some countries in Asia the idea of catching up in the near future should be dispelled.

Finally, it is interesting to, compare our back-of-the-envelope calculations with the Asian Development Bank's (ADB's) (1997) simulations for Asia, summarized in Table 6. ADB's projections provide a baseline and two simulations. For example, in the case of China, with a growth rate of 6%, as forecasted by ADB's baseline (and assuming the same growth rate between 2025 and 2050), China could catch up with the US, according to Tables 4 and 5, towards the year 2050. If, on the other hand, China implemented inward-looking policies, this would make the growth rate decline to 4.4%, and thus would push China's catching up back to sometime between 2075 and 2100. For the other Asian giant, India, the baseline growth rate of 5.5% implies that catch up with the US would take place sometime between 2050 and 2075. If India adopted

Table 6. Growth rates and ADB projections

| | Output per worker | | | Output per capita | | | ADB projections | | | |
| | | | | | | | Baseline | | East Asian standard | Inward policies |
	$ 1960	$ 1990	Annual growth rate (%)	$ 1960	$ 1992	Annual growth rate (%)	GDP per person relative to the US in 2025	Per person GDP growth rate, 1995–2025	Per person GDP growth rate, 1995–2025	Per person GDP growth rate, 1995–2025
Bangladesh	2768	4790	1.39	936	1510	0.95	17.2	3.9	7.3	3.3
China	1076	2189	3.10	567	1493	3.62	38.2	6.0	6.6	4.4
Hong Kong	4172	22827	5.38	2247	16471	6.15	116.5	2.1	2.1	0.5
India	1761	3235	2.05	766	1282	1.76	24.4	5.5	6.9	3.9
Indonesia	1638	5024	4.46	638	2102	4.44	35.8	5.0	5.6	3.5
Korea	2703	16022	6.05	904	7800	6.88	82.6	3.5	3.5	2.0
Malaysia	4110	12527	3.75	1420	5746	4.47	71.2	3.9	4.1	2.2
Myanmar	689	1400[a]	1.92	316	725[a]	2.02				
Nepal	1280	2298[a]	3.09	628	1010[a]	1.88				
Pakistan	2027	4639	2.38	638	1432	2.24	18.1	4.4	7.9	3.8
Philippines	2971	4784	1.62	1133	1689	1.35	28.5	5.3	6.5	3.7
Singapore	5008	24369	5.53	1658	12653	6.94	107.0	2.5	2.5	0.9
Sri Lanka	3508	5742	2.08	1259	2215	2.27	25.3	3.9	5.3	2.3
Taiwan	3374	18409	5.69	1256	9000[a]	6.28	88.0	3.1	3.1	1.4
Thailand	1884	6759	3.89	943	3942	4.22	47.4	3.8	4.0	2.1
Japan	4998	22629	4.62	2954	15105	4.63				
US	24433	36771	1.10	9895	17945	1.81				

a: Estimate.

Sources: Author's calculations and Asian Development Bank (1997, table 2.11).

"East Asian policies" it could achieve a growth rate of 6.9%, and thus it could catch up with the US around the year 2050. Finally, if India adopted inward-looking policies, the growth rate would decline to 3.9%, and catch up would not take place until the 22nd Century.

It is worth noting, finally, that the ADB growth rates in the baseline for all South Asian countries as well as for China, Indonesia and the Philippines are higher than the average annual growth rates of output per capita that the countries registered during the period 1960–92 (third column of Table 6). And in the case of the South Asian countries, China and the Philippines, the growth rates, under the assumption that they follow inward policies, are still higher than those for the period 1960–92. This leads us to conclude that the forecasts provided by the ADB are too optimistic and very likely not feasible.

4. Estimates of the Impact of the Financial Crisis: The Lost Decade

> There is no guarantee, because growth has been maintained on the average for a run of years, that it will continue. At any stage in the process of accumulation, a sufficiently drastic financial collapse may throw the investors into a state of self-fulfilling pessimism, which postpones recovery indefinitely.
>
> (Robinson, 1977, p. 1331)

After decades of consistently remarkable economic performance, a number of countries in East and Southeast Asia were suddenly hit by a financial shock during the second half of 1997. What was initially thought a transitory malaise in the currency and financial markets deepened into an economic crisis of massive proportions, and the end does not seem to be in sight. The severity of the crisis is reflected in the abrupt and steep downturns of GDP growth which are having deleterious social consequences. The worst hit countries, Indonesia, Korea and Thailand, have implemented restructuring programmes with the support of the IMF and the World Bank.[18] This section provides a rough estimate of the impact that the financial crisis will have in the catching-up race.[19] For this, some assumptions are made as to how the crisis impacts on the growth rate of GDP per capita. Then I recalculate expression (3). It is assumed that the impact of the crisis will be felt for 7 years, between 1997 and 2003; afterwards, in the year 2004, the three countries return to the average growth rate of the last 30 years. Of these 7 years, 1998 and 1999 are the worst, with the three countries suffering severe recessions. Positive growth of around 1.5% begins in 2000, although still the growth rate in per capita terms is zero. These assumptions appear in Table 7.[20] The first column shows the (actual) average growth rate during the previous 30-year period. The next eight columns show the assumptions about the impact of the crisis in terms of GDP per capita growth. The last column shows the results of the new set of simulations, namely, the number of years by which catching up with the US is postponed.

The results indicate that Korea will defer catching up with the US by around one decade, Indonesia and Thailand by one-and-a-half decades. This represents one-third to one-half of the "miracle". To provide an even clearer picture of the effects of the crisis, consider what occurred to Indonesia with respect to the US in 1998. In per capita terms, output decreased in the former by almost 16%, while in the US it increased by almost 3%. This implies that in 1998 alone, the per capita income gap between Indonesia and the USA widened by around 18 percentage points. I conclude that the effect of the financial crisis in East and Southeast Asia will be to "lose" at least one decade in the development race, no different from what happened to Latin America

Table 7. Impact of the financial crisis

	Average growth rate 1960–1992	1997	1998	1999	2000	2001	2002	2003	2004	Change in number of years to catch up
Indonesia	4	3	−11.5	−2	0	1	2	3	4	15
Korea	6	4	−6.5	−2	0	1	3	4	6	9
Thailand	4	−1.5	−6.5	−2	0	1	2	3	4	14

Notes: Figures in the table are annual growth rate percentages, except the last column (years). US GDP per capita income is assumed to grow by 2.8 and 2% in 1997 and 1998, respectively. In other years it stays at 1.75%.

during the 1980s.[21] This recession, moreover, will have deep and long-lasting overall implications for the economies and societies of the region. This is not to say that these countries will not resume growth. The East Asian countries will indeed recover in due time, but will not grow again as in the past.

5. Summary and Conclusions: *Waiting for Godot*

In this paper I have discussed several questions relating to the debate on Asia's growth and its future. The recent financial crises have led many to doubt that Asia can continue achieving high growth rates. Others, however, feel that within a short span of time Asia will reemerge and become the world's centre of economic activity. Will the 21st Century be the *Pacific Century*? The thesis presented in this paper is that the constraints for Asia to become the world's centre of economic activity in the near future are binding. First, if one looks into the region, one finds that countries have drifted apart in per capita income during the three decades after 1960. Those with a higher per capita income in 1960 have grown faster during the 30-year period considered, and thus have opened an even bigger gap. Thus, the idea of a homogeneous Asia growing together, and where all countries have equally benefited from trade, investment and technological spillovers, is false. Second, the gap with the US, the leader, has not been reduced, in the sense that poorer countries closed it faster. Third, there is no evidence of catch up of the Asian countries, as a group, with the US (group catch up). However, a number of them have certainly reduced the income per capita gap with the leader (individual catch up). Fourth, the countries of the region will not approach the US in the near future. Using a very simple framework, I have estimated the time it will take for the Asian countries to catch up with the US. Under reasonable assumptions about future per capita growth rates, it appears that catching up will not occur soon. The compounding effect of growth is tremendous: a small gap in growth today makes a huge difference in the long run. Possible technological breakthroughs in the near future will mostly benefit the developed countries. Fifth, the financial crisis will have the effect of making the affected countries lose at least one decade in the development race. Certainly one can argue that in another 100 *years* the Asian countries will catch up with the rich, which then will be even richer (Prescott, 1998). But this is like waiting for Godot: it will not come in our lifetime. Although 100 years is nothing in the context of the history of humanity, it is a very long time for those living in poverty today. It is the Keynesian long run. The late entry of most less-developed countries into the economic race may prevent them from ever competing with the developed nations; instead they will just fade further and further behind.

Notes

1. Culturally, technologically?
2. The data set used in the paper is the Penn World Table Mark 5.6. For a discussion of data issues, and problems of comparison, see Crafts (1997).
3. Mankiw *et al.* (1992) argued that what the standard Solow's growth model predicts is not absolute convergence, but conditional convergence (each country converges to its own steady state at diminishing growth rates). We only consider the notion of absolute convergence, for this is the one policy—makers in developing countries implicitly refer to when they talk about development and growth.
4. Although the hypothesis of convergence is a well-known corollary of Solow's growth model, this idea also appears in other models. See, for example, the Gerschenkron (1962) notion of "advantages of backwardness".
5. It is important to note the lower dispersion in income among the high-performing economies than within the whole group.
6. Average growth rates are constructed as the trend coefficient from a regression of the log level on a constant and linear trend.
7. Abramovitz (1986, pp. 387–389) refers to the social capabilities as a set of "tenacious societal characteristics". These encompass a country's political, commercial, industrial and financial institutions, education, organization and management of large-scale enterprises, openness to competition, etc. Abramovitz (1986, p. 387) indicates that a country's potential for rapid growth is strong when the country is technologically backward but socially advanced. For example, the Philippines of the Marcoses is an example of a country that lacked social capabilities and which managed to develop a unique anti-growth culture.
8. Gomulka (1971) had already proposed a catch-up relation of the form $g = a + b \ln(G)$.
9. Other functional forms were tested, obtaining the same results. In all cases the gap variable is positive and statistically significant.
10. For example, considering Indonesia and Singapore with respect to the US, it is clear that the two Southeast Asian countries grew faster than the US, but while Indonesia's GDPs per worker in 1960 and 1992 were US $1638 and US $5349 (increased 3.26 times), respectively, the corresponding figures for Singapore were US $5008 and US $26 631 (increased 5.31 times); and for the US $24 433 and US $36 549 (increased 1.49 times). The annual growth rates of Singapore were consistently higher than those of Indonesia, except for 1980–85 (and about the same for 1970–75).
11. The relationship between productivity growth and the gap has been modelled as linear in view of the results above.
12. The instruments used were: constant term, G, G^2, I/Q, H. Equation (2) was also estimated with standard ordinary least squares: G and I/Q continue to be insignificant, while H and q are significant. The only difference is that estimated a_2 is higher than with TSLS, around 0.9 in the three equations.
13. Since the results in the previous section indicate a similar pattern in terms of output per capita and output per worker, in this section we only use the data in per capita terms.
14. Obviously, the notion of catch up used in this section is not the same as that discussed before, for here we consider each country individually with respect to the US.
15. Naturally one may ask why the target is the US per capita income. It could equally have been the OECD average (lower than that of the US). I think what matters is the idea behind the exercises and the inferences that can be drawn. If I had chosen the OECD average, but had applied a slightly higher growth rate, such as 2%, the results would be very similar. Likewise, I think it is more meaningful exercise to allow per capita income in the US to continue growing, rather than keeping it fixed at today's level and estimating when the Asian countries will reach it.
16. Of course, given that the US begins at a much higher base than the other countries, for a large part of the catching-up period, the gap is actually increasing. If in the meantime a crisis occurs, things will get worse. See Section 4.
17. This forecast is absolutely wrong. Output growth rates for 1998 are (%): Bangladesh, 5.6; India, 5.8; Pakistan, 5.4; Sri Lanka, 5; Nepal, 1.9; China, 7.8; Indonesia, − 13.7; Malaysia, − 6.2; the Philippines, − 0.5; Singapore, 1.5; Thailand, − 8; Japan, − 2.8; Korea, − 5.5; Taiwan, 5.1; Hong Kong, − 5; Mongolia, 3.5; Bhutan, 5.1; Lao PDR, 5; US, 3.9. In per capita terms, these figures would be 1–2.5 percentage points lower, depending on the country.

18. Thailand signed the seventh letter of intent with the IMF in March 1999.
19. For a recent analysis of the crisis in Korea, see Chang *et al.* (1998).
20. At the outset of the crisis it was thought that the countries would recover very quickly, following a V-shape path (i.e. quick slump followed by a quick recovery). Then, when more countries become immersed, analysts thought of a slower U-shape recovery path. The latest analyses are more pessimistic about the recovery of the region, and in fact talk about an L-shape-type where no recovery is envisaged; some analysts predicted a 20% contraction in Indonesia in 1998. The preliminary figure is around 13%. These simulations were undertaken before figures for 1998 were released. Notice that our assumptions for Indonesia and Thailand are higher than the preliminary growth rates. This means that the situation is even worse. For Korea, it is the reverse.
21. A World Bank report estimates that the impact of the crisis in Indonesia is such that poverty could increase to nearly 15% of the total population by March 2000 (World Bank, 1993). This implies that there would be 29–30 million poor people in Indonesia, an increase of about 8 million over 1996. It is difficult to believe that the effects of the crisis will be transitory and that within a couple of years things will be back to normal.

Bibliography

Abramovitz, M. (1986) Catching up, forging ahead, and falling behind, *Journal of Economic History*, XLVI, pp. 385–406.

Asian Development Bank (1997) *Emerging Asia* (Oxford, Oxford University Press).

Barro, R. (1991) Economic growth in a cross section of countries, *Quarterly Journal of Economics*, May, pp. 407–443.

Barro, R. (1997) *Determinants of Economic Growth. A Cross-country Empirical Study* (Cambridge, MA, The MIT Press).

Barro, R. & Sala-i-Martin, X. (1992) Convergence, *Journal of Political Economy*, 100, pp. 223–251.

Baumol, W.J. (1986) Productivity growth, convergence, and welfare: what the long-run data show, *American Economic Review*, 76, pp. 1072–1085.

Baumol, W. & Wolff, E.N. (1988) Productivity growth, convergence and welfare: reply, *American Economic Review*, 78, pp. 1155–1159.

Benhabib, J. & Spiegel, M. (1991) *Growth Accounting with Physical and Human Capital Accumulation*, Research Report 91–66, New York University, C.V. Starr for Applied Research (December).

Benhabib, J. & Spiegel, M. (1992) *The Role of Human Capital and Political Instability in Economic Development*, Research Report 92–24, New York University, C.V. Starr for Applied Research (May).

Boltho, A., Dadush, U. & Otsubo, S. (1996) China's emergence: prospects, opportunities and challenges, *Asian Economic Journal*, 10, pp. 271–289.

Campos, J.E. & Root, H.L. (1996) *The Key to the Asian Miracle: Making Shared Growth Credible* (Washington, DC, The Brookings Institution).

Cohen, D. (1998) *The Wealth of the World and the Poverty of Nations* (Cambridge, MA, The MIT Press).

Collins, S. & Bosworth, B.P. (1997) Economic growth in East Asia: accumulation versus assimilation, in: W.C. Brainard & G.L. Perry (Eds) *Brookings Papers in Economic Activity, 2: 1996*, (Washington, DC, The Brookings Institution), pp. 135–203.

Chang, H.-J., Park, H.-J & Yoo, C.J. (1998) Interpreting the Korean crisis: financial liberalisation, industrial policy and corporate governance, *Cambridge Journal of Economics*, 22, pp. 735–747.

Crafts, N. (1992) Productivity growth reconsidered, *Economic Policy*, 15, pp. 388–426.

Crafts, N. (1997) Economic growth in East Asia and Western Europe since 1950. Implications for living standards, *National Institute Economic Review*, 162, pp. 75–84.

De Long, J.B. (1988) Productivity growth, convergence and welfare: comment, *American Economic Review*, 78, pp. 1138–1154.

Dixon, R.J. & Thirlwall, A.P. (1975) A model of regional growth-rate differences on Kaldorian lines, *Oxford Economic Papers*, 11, pp. 210–214.

Easterlin, R.A. (1981) Why isn't the whole world developed?, *The Journal of Economic History*, XLI, pp. 1–19.

Easterly, W. (1993) Explaining miracles: growth regressions meet the gang of four. World Bank, *NBER 4th Annual East Asian Seminar on Economics*, San Francisco, June 17–19.

Felipe, J. (1998) The Role of the manufacturing sector in Southeast Asian development: a test of Kaldor's First Law, *Journal of Post Keynesian Economics*, 20, pp. 463–485.

Felipe, J. (1998) Singapore's aggregate production function and its (lack of) policy implications, Georgia Institute of Technology.

Felipe, J. (1999) Total factor productivity growth in East Asia: a critical survey, *Journal of Development Studies*, April, pp. 1–41.

Felipe, J. & McCombie, J.S.L. (1997) Methodological problems with recent analyses of the East Asian miracle, Georgia Institute of Technology.

Freeman, C. & Soete, L. (1997) *The Economics of Industrial Innovation*, 3rd edn (Cambridge, MA, The MIT Press).

Gerschenkron, A. (1962) *Economic Backwardness in Historical Perspective: A Book of Essays* (Cambridge, MA, Belknap Press).

Gomulka, S. (1971) *Inventive Activity, Diffusion and the Stages of Economic Growth* (Aarhus, Aarhus University Press).

Grier, K.B. & Tullock, G. (1989) An empirical analysis of cross-national economic growth, 1951–80, *Journal of Monetary Economics*, 24, pp. 259–276.

Heston, A. (1994) Income levels, growth and price structures in the ESCAP region, 1960–90 *Journal of Asian Economics*, 5, pp. 1–13.

Hobday, M. (1995) *Innovation in East Asia. The Challenge to Japan* (Cheltenham, Edward Elgar).

Huff, W.G. (1995) What is the Singapore model of economic development?, *Cambridge Journal of Economics*, 19, pp. 735–759.

Kaldor, N. (1966) *Causes of the Slow Rate of Growth in the United Kingdom. An Inaugural Lecture* (Cambridge, Cambridge University Press).

Klenow, P.J. & Rodriguez-Clare, A. (1997) The neoclassical revival in growth economics: Has it gone too far?, in: B.S. Bernanke & J.J. Rotemberg (Eds) *NBER Macroeconomics Annual 1997* (Cambridge, The MIT Press), pp. 73–114.

Koppel, B. (1997) Fixing the other Asia, *Foreign Affairs*, 77, pp. 1–13.

Kormendi, R.C. & Mequire, P. (1985) Macroeconomic determinants of growth: cross-country evidence, *Journal of Monetary Economics*, 16, pp. 141–163.

Krugman, P. (1994) The myth of Asia's miracle, *Foreign Affairs*, November/December, pp. 62–78.

Kuznets, S. (1971) Modern economic growth: findings and reflections, *Nobel Lectures: Economic Sciences* (World Scientific).

Mankiw, N.G., Romer, D. & Weil, D.N. (1992) A contribution to the empirics of economic growth, *Quarterly Journal of Economics*, 107, pp. 407–438.

McCombie, J.S.L. & Thirlwall, A.P. (1994) *Economic Growth and the Balance of Payments Constraint* (New York, St. Martin's Press).

National Environment Management Action Plan (NEMAP), Bangladesh, 1995.

Pack, H. (1994) Endogenous growth theory; intellectual appeal and empirical shortcomings, *The Journal of Economic Perspectives*, 8, pp. 55–72.

Pack, H. & Westphal, L.E. (1986) Industrial strategy and technological change. Theory versus reality, *Journal of Development Economics*, 22, pp. 87–128.

Parente, S.L. & Prescott, E.C. (1993) Changes in the wealth of nations, *Federal Reserve Bank of Minneapolis Quarterly Review* (Spring), pp. 3–16.

Penn World Table Mark 5.6 downloaded from Web Site, University of Pennsylvania, http://www.nber.org/pwt56.html.

Pilat, D. (1994) *The Economics of Rapid Growth: The Experience of Japan and Korea* (Cheltenham, Edward Elgar).

Prescott, E.C. (1998) Needed: a theory of total factor productivity, *International Economic Review*, 39, pp. 525–551.

Quibria, M.G. (1995) Introduction, in: M.G. Quibria (Ed.) *Critical Issues in Asian Development* (Oxford, Oxford University Press), pp. 1–16.

Radelet, S. & Sachs, J. (1997) Asia's reemergence, *Foreign Affairs*, November//December, pp. 44–59.

Robinson, J. (1977) What are the questions?, *Journal of Economic Literature*, XV, pp. 1318–1339.

Rohwer, J. (1995) *Asia Rising* (Singapore, Butterworth-Heinemann Asia).

Rouen, R. (1997) *China's Economic Performance in an International Perspective* (Paris, Paris Development Centre of the Organisation for Economic Cooperation and Development).

Schmitz, J.A. (1993) Early progress on the problem of economic development, *Federal Reserve Bank of Minneapolis Quarterly Review*, Spring, pp. 17–35.

STARS database, World Bank.

Stiglitz, J. (1996) The role of government in economic development, in: M. Bruno & B. Pleskovic (Eds) *Annual World Bank Conference on Development Economics 1996* (Washington, DC, The World Bank), pp. 11–26.

Temple, J. (1999) The new growth evidence, *Journal of Economic Literature*, XXXVII, pp. 112–156.

Verspagen, B. (1991) A new statistical approach to catching up or falling behind, *Structural Change and Economic Dynamics*, 2, pp. 359–380.

Wade, R. (1993) The visible hand: the state and East Asia's economic growth, *Current History*, December, pp. 431–440.

World Bank (1993) *The East Asian Miracle Report. Economic Growth and Public Policy* (Oxford, Oxford University Press).

7