Center for Studies in Demography and Ecology

Human Resource Development and the Asian Economic Crisis: Facts, Issues, and Policy

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CSDE Working Paper No. 99-05

Forthcoming in the *Asian Development Review*

Human Resource Development and the Asian Economic Crisis: Facts, Issues, and Policy

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January 1999

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1. Introduction

Developing Asia has experienced massive economic transformation in the last 30 years. During this period Asia has emerged as the fastest growing region in the world and closed its economic gap with the industrial countries.[1] A combination of factors accounts for this dramatic transformation of much of the Asian economy, now widely referred to as the Asian miracle. These factors, on which there is wide consensus, include stable macroeconomic policies, openness to trade, high saving rates, generally sound institutional frameworks, high literacy rates, and favorable demographic characteristics. However, not all of developing Asia shares these characteristics, nor has all of developing Asia been part of the Asian miracle in the same manner as East Asia has been. Indeed, the miracle largely bypassed some parts of Asia, such as South Asia and the Philippines. However, things have started to change for these economies. Since 1990 South Asian countries have undertaken significant reforms of their policy frameworks and laid strong economic foundations for growth. The Philippines has also made significant improvements in its policy and institutional framework, which has been accompanied by greatly improved economic performance. The great convergence toward market-based, outward-oriented economic policies throughout developing Asia in the last few years has been remarkable.

Nevertheless, despite improvements in policies and institutions, many of Asia's high performing economies seem to be facing a serious challenge to their economic growth as a result of the ongoing financial turmoil. To most observers, this turmoil reflects structural problems such as institutional frailties in the financial sector and weaknesses in its systems of corporate governance. It is believed that once these issues begin to be dealt

[1] Between 1965 and 1990, gross domestic product (GDP) in Asia grew by an average annual rate of 3.8 percent per person, compared with the industrial countries' average annual growth rate of 2.7 percent per person. The newly industrialized economies (NIEs) grew even faster, at a rate of 6.7 percent per person (Asian Development Bank 1997).

with, and this will not be an easy nor quick task, growth will resume.

However, the challenge to a resumption of “miracle” growth rates may appear from other sources. In particular, gaps in human skills and in technological capabilities may be the main binding constraints on future growth. That this is not a mere theoretical possibility is suggested by the main precursor to the financial crisis - the export deceleration of 1996 that arguably was the trigger for the ensuing crisis (Asian Development Bank 1998). Much of that deceleration in exports may well have been cyclical, for example, caused by the downturn in demand for electronic products. But a more worrying possibility, at least for the Southeast Asian tigers, is that the lack of an adequate supply of well-trained technicians, engineers, and scientists constrained the ability of these economies to move from simple assembly-line operations in foreign-built plants toward designing and developing products in the face of competition from lower wage economies such as the PRC and Vietnam.

For the other more advanced economies of East Asia, it has been asserted that they are fast approaching the end of growth attainable through input mobilization (Krugman 1994). Further acceleration of growth would require technological progress attainable through new innovations that stem from a sophisticated endowment of human capital that is absent in these economies.

These occurrences have raised concerns in many quarters. Is this the end of the Asian miracle? While the full answer to this question is beyond the scope of this paper, it addresses the issue in terms of those aspects of human resource development which relate to knowledge and skills. This perspective is important, because ultimately it is the quality of human resources in terms of peoples’ knowledge and skills that constitutes the basic foundation on which economic miracles are built. This is the critical determinant of the structure of production, of competitiveness, and of technological and managerial innovations. It is also a determinant of whether a country can move up the economic ladder from one stage of economic development to another.

This is not to downplay the policies that played a critical role in the economic transformation of developing Asia. Indeed, one only has to look at the disappointing growth experience of the ex-communist economies to realize that investing in education alone is not a magic formula that will solve the problems of economic growth. Policies and institutions matter a great deal. As Murphy, Schliefer and Vishny (1991) have pointed out, talent and education are drawn towards entrepreneurial activities when policies and institutions allow people to organize firms with ease and retain their profits. Conversely, when policies and institutions encourage rent-seeking activities, the talented and educated are drawn to these. Given the trend toward convergence of policies and institutional framework in much of Asia (a trend which will no doubt be hastened by the recent financial crisis and policy responses emerging thereof) the quality of the workforce will largely determine the differences in performance across its economies in the future.

There is another reason why the returns from investing in human resources will be critical for future prosperity even if they have not always been so in the past. This reason is closely related to a point made by Schultz (1975) about the value of education in dealing with disequilibria – or changes in economic conditions – and which is clearest in agrarian contexts. According to Schultz, in an environment where agricultural practices were technologically stagnant, farmers' education would not do much in terms of raising production. However, when exposed to new technologies and practices, it is the educated farmers who can translate the new technology into production increases most effectively. This point applies equally well to other sectors of the economy including manufacturing and services. It also takes on an added force given the inexorable forces of globalization. Globalization has increased technology flows from developed to developing countries. As in the case of Schultz's farmer, it is the well educated who are in a position to gain the most from the introduction of new technology.

The remainder of this paper is organized as follows. First, it makes clearer the relationship between investments in human resources and economic growth. Next, it describes broad trends in various dimensions of human resources as they relate to knowledge and skills in the Asian economies before highlighting some of the lacunas that currently exist in Asia's investments its human resources and its technological capabilities. The final sections describe broad strategies for developing human resources and technological capabilities. These strategies are sensitive to the considerable variation that exists among Asian Developing Economies (ADEs) in their levels of development, human resources, and technological capabilities.

2. The Importance of Human Resource Development to Growth

In order to improve its standard of living, an economy must produce greater amounts of goods and services per worker. In other words, it must ensure that the productivity of its workers increases. This may be achieved by equipping workers with more tools, that is, investing in physical capital, but may also be achieved by investing in *human* capital to improve the quality of human resources. In fact, a strategy based only on accumulation of physical capital will soon run into diminishing returns (Krugman 1994). For all practical purposes, it is only technological progress that can allow sustained growth of output per worker. Additionally, contrary to what many early economic growth models assumed for simplicity (for example, Solow 1956, 1957), technological progress does not fall like "manna from heaven". Instead, it is the outcome of human endeavor and depends critically on the quality of human resources. Even when technology does appear to fall like manna from heaven, as it may be the case with technological latecomers, adopting successfully the new technology developed elsewhere is no easy task. It is ultimately tied to the quality of human resources once again.

Investing in human capital to augment the quality of human resources can take many forms. Perhaps the most basic of these are investments in peoples' health. Research conducted in a variety of developing countries has confirmed that the adverse effects on productivity of poor health and nutrition—as reflected in inadequate calorie intake, low weight-for-height, or low body mass—are considerable (for example, Strauss 1986, Deolalikar 1988, etc.). Moreover, it is not just the ability to carry out strenuous work that suffers. Inadequate nutrition, especially when measured in terms of low height-for-age among children, has long-term and lasting adverse effects on cognitive development and schooling achievements (Jamison 1986, Moock and Leslie 1986). These are likely to lead to lower labor productivity in adulthood.

While the productivity effects of nutrition and health are strongest at low levels of nutrition and income, they level off at higher income and nutrition levels (Strauss 1986). Further improvements in productivity can only be sustained if workers possess the knowledge and skills required not only to utilize given tools and technology effectively, but also to generate and manage new tools and technology. Workers accumulate this technological capability in myriad ways. On the job training and learning are important, as are research and development (R&D) activities that are undertaken precisely for the purpose of developing new technologies or utilizing effectively those developed elsewhere. However, it is no exaggeration to say that formal education is the key building block of technological capability.

To what extent is worker productivity associated with education? It is difficult to deny that schooling yields important pecuniary returns to individuals in the form of higher earnings. These returns can be relatively large in developing countries and some estimates indicate private rates of return to schooling in Asia as high as 31 percent (see Psacharopoulos 1988 for a survey of various estimates). It is of course possible that only a small part of these returns reflect the productivity enhancing effect of education. The rest could reflect the importance of credentials in higher paying jobs or education as a screening device that allows employers to distinguish between high-ability and low-ability individuals, because high-ability individuals will go through school more easily than low-ability individuals (for example, Spence 1976)

However, carefully conducted research in both developed as well as developing countries has demonstrated that the effects of schooling on wages works primarily through its positive impact on cognitive achievements (for example, Alderman, Behrman, Ross, and Sabot 1996, Ashenfelter and Krueger 1994, etc.). Moreover, in addition to enabling workers to do everyday tasks more efficiently, education - even of the basic kind - is found to facilitate the adoption of new tools and technologies indicating that the returns to education are not a given constant as argued by Schultz (1975). Instead they vary with the context and would be higher in a setting where technology changes rapidly.

A recent study uses India's experience with the green revolution to shed light on this issue (Foster and Rosenzweig 1996). Using data on rural households, farming inputs, and crop yields, Foster and Rosenzweig find that while farmers with a primary education were in general more productive than their uneducated counterparts, the productivity differential was greatest in those regions which were especially conducive to the cultivation of the new high-yielding varieties of seeds. In these regions educated farmers' profits grew to be as much as 46 percent more than those of uneducated farmers. The findings strongly suggest that the benefits of education are strongest in the context of changing circumstances. The introduction of the new high-yielding varieties of seeds represented a new technology and it was the educated who responded the best to the new technology.

Supportive evidence comes from research using industrial data from three developing economies including Taipei,China (Tan and Batra 1996). The results of this research indicate that while firms' investments in activities to enhance workers' knowledge, such as training programs, lead to higher wages and productivity for both skilled (typically well-educated) and unskilled labor, the gains made by skilled workers are much larger. For example, the results for the firms in Taipei,China indicated that skilled workers in firms that invest in training see, on average, a 54 percent wage premium over similar workers in firms that do not invest in training, while unskilled workers in the investing firms see, on average, only a 15 percent wage premium over their counterparts in non-investing firms. Moreover, the results also revealed that training skilled workers leads to large gains in productivity, while training unskilled led to significantly smaller gains.

In addition to this micro-level evidence, some recent evidence using cross-country data also points to the dependence of returns to education on an economy's context. There exists a number of empirical studies that use enrollment rate data as proxies for growth in human capital and find the accumulation of human capital to be important to economic growth in cross-country growth regressions.[2] One twist to these studies is provided by Mingat and Tan (1996) who separate countries into three groups, low, middle, and high income. Their results suggest that the benefits by level of education are sensitive to countries' economic circumstances. In particular, whereas the typical low income country would benefit most by expanding its coverage of primary education, middle and rich income countries would benefit most by expanding their coverage of secondary and tertiary education, respectively. As Mingat and Tan point out, the simplicity of production technology, economic processes, and commercial and legal institutions and the limited scope for specialization of labor in low income countries relative to higher income ones could explain why expanding the supply of highly educated people in these economies may not have too much impact on economic growth. By contrast, for more developed countries which are at or are near the frontiers of technology, sustaining growth comes from developing new technologies and refining older ones. And in this it is practically impossible to deny the key role higher education plays in enabling activities, such as R&D,

[2] The use of enrollment rates as a proxy for growth in human capital is not without its critics, however. See, for example, Pritchett (1996).

which are undertaken precisely to push forward the frontiers of technology and knowledge.

However, higher education and the technological capability it instills in a workforce can be of benefit to developing economies also.[3] This can be seen by examining the returns to activities such as R&D which are intensive in their use of highly educated individuals. In general, investigators have looked most closely at the economic benefits to developing countries from R&D activities in the field of agriculture. In this context, the evidence from public sector agricultural research programs in Asia suggests that the internal rates of return to R&D activity have been on average 56 percent (see the survey by Evenson and Westphal 1995). Few estimates of the rate of return for industrial R&D in the developing world exist. Those that do tend to be based on studies that have used data from private Indian manufacturing firms and report returns in the range of 25 to 80 percent (Deolalikar and Roller 1989, Basant and Fikkert 1996, Hasan 1997).

The paucity of studies of industrial R&D in the ADEs should not be taken as an indication of its general lack of relevance to these economies. R&D can be of many types, and it is important to distinguish between R&D which is geared toward extending the frontiers of technical knowledge, and R&D which is geared toward adapting and assimilating technologies developed elsewhere, typically in the industrial world. For the ADEs, it is the latter type that is more relevant at this point in time. Contrary to some popular beliefs, this type of R&D is far from costless or trivial in its implications. Such R&D has enabled firms in the ADEs not only to use imported equipment and technology more effectively, it has also facilitated the acquisition of technology from foreign firms on more economic terms (Deolalikar and Evenson 1989).

More impressively, adaptive and applied R&D in ADE firms has also enabled them to modify technologies that they had previously imported and to export it successfully on

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[3] In this context, Khan (1998a, b) has developed the interesting concept of a positive feedback loop innovation system (POLIS). According to this view, R&D and human resource development are complements in a production function for innovative activities. Both are necessary if innovation is to go on. For NIEs in particular these complementarities are of particular significance.

the basis of their modifications. The technological capability to do this is fundamentally important in creating new bases of comparative advantage. While emphasizing industrial R&D and technology development may not be critical for building a solid base in the production and export of low value-added, low technology goods, it is critical for building a complex industrial structure and shifting production to higher value-added goods.

3. How Much Is Developing Asia Investing in Education and Technology?

In the absence of adequate investment in human resources, the ADEs would be seriously hindered in their efforts to sustain economic growth in an increasingly competitive and integrated world. In this section, we examine the state of literacy, education, and some broad indicators related to technology development and technological capability among the ADEs. The section then discusses what the latter indicators suggest for these economies' long run growth prospects in the light of recent economic developments.

Literacy, Education, and Technology Development

One rough but ready measure of the stock of human capital is the literacy of the adult population. As an examination of adult literacy rates across selected ADEs in Table 1 reveals, typically more than 80 percent of the adult populations of East and Southeast Asian economies are literate. This is in sharp contrast to many South Asian economies which still have literacy rates below 50, if not 40 percent! Of course, it is true that these South Asian economies (Bangladesh, India, Nepal, and Pakistan) have shown much improvement over the last 30 years. However, some of the most impressive improvements in adult literacy have taken place in Southeast Asia. For example, whereas Indonesia had a literacy rate that was around 11 percentage points higher than that of India in 1961, the gap between the two had increased to about 32 percentage points by 1995.

It is true that over time and with the increasing coverage of basic education in all of these economies (see below), the fraction of the adult populations that are illiterate will decline substantially. However, the large illiterate populations in South Asia are likely to continue to act as a drag on their economies for some time to come unless programs designed to target adult illiteracy are introduced in a big way.

What of Asia's investments in human capital? Despite a number of problems, enrollment rates [4] at various levels of schooling – i.e., the number of students enrolled in education at a particular level divided by the population in the age range corresponding to that educational level – do provide a measure of the investments being made in human capital. They can also be used as an approximate measure of education outcomes and can be useful in highlighting various broad features regarding education. Indeed, a comparison of gross enrollment rates across the selected ADEs reveal a number of interesting features.

Consider, first, Table 2 on enrollment rates in primary education. The table reveals that as in the case of adult literacy, many East and Southeast Asian economies have been quite successful historically in the provision of primary education especially in comparison to perhaps all South Asian economies with the exception of Sri Lanka. However, there has been a rapid improvement in the provision of primary education in South Asian economies (plus such Southeast Asian laggards such as Laos). As a result, the dispersion of enrollment rates among Asian economies is much less today than it was.

Nevertheless, a more careful look beyond the enrollment rates reveals that access to a decent primary education is a serious problem in the low income economies of Asia, especially in South Asia and some economies of Indo-China. First, access by children across income groups and gender in these economies can vary greatly. For instance, in

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[4] For example, enrollment rates are typically based on annual enrollment surveys conducted at the beginning of the school year. If dropping out of school in the course of the academic year is significant, then the reported enrollment rates will overstate effective enrollment rates. See Behrman and Schneider (1994) for a more complete discussion of the limitations of enrollment data.

Cambodia and Laos, the gross primary school enrollment rate for children from the wealthiest 20 percent of families is, respectively, 35 and 43 percent greater than that for the poorest 20 percent (Deolalikar 1997). Similarly, in India the gross primary school enrollment rate of girls is only 80 percent that of boys while in Pakistan the figure is only 50 percent (Deolalikar 1997).

Second, enrollment rates do not tell us too much about the quality of education being provided. Direct measures of quality of education, such as performance on standardized test scores, are hard to come by. Nevertheless, there are a number of indirect measures of the quality of education. One manner in which low quality can manifest itself in is through high rates of dropout and grade repetition. Although high rates of dropout could reflect the perceived lack of relevance of education, especially in rural areas, there is evidence to suggest that poor quality of schooling can lead students (prompted by their parents) to dropout (Dreze and Gazdar 1997, Hanushek 1995). The problem of dropping out seems particularly acute for South Asian economies such as Bangladesh, India, Nepal, and Pakistan and for some of the Indo-China countries such as Laos and Cambodia also (Chuard and Mingat 1996, Deolalikar 1997, Tan and Mingat 1992). For example, the evidence suggests that of the cohort of children who enter primary school in low-income ADEs such as Bangladesh, Pakistan, Nepal, and Laos, only about half complete grade 6 (Deolalikar 1997). Moreover, in some of these countries, about a quarter of all children repeat a grade and, as a consequence, some children spend two to four years longer in primary school than normal.

Consider next enrollment rates across the ADEs at the secondary level of education (Table 3). As is the case for primary education, these enrollment rates do not capture issues relating to quality. Nor do they describe to us the related problems of high dropout rates, grade repetition, and gender and income biases. Nevertheless, as rough measures of the investments in education, these do reveal some interesting features. First, the cross-country variation in enrollment rates is much greater at the secondary level than at the primary level. For example, while Bangladesh had a gross secondary enrollment rate of 20 percent in 1992, Korea's enrollment rate was 90 percent. Second, the enrollment rates in secondary education in some of Asia's higher performing economies seem inadequate, particularly given their higher income levels.

This can be seen most clearly by comparing actual enrollment data at the secondary level alongside those predicted by each country's level of development as proxied by their income levels as in Figure 1.[5] As may be expected, countries with higher per capita incomes also tend to have higher enrollment rates although, as the figures make clear, the relationship is by no means a watertight one. The surprising feature, however, is the large and negative differences between actual and predicted enrollment rates for such high performing economies as Hong Kong, China, Malaysia, Singapore, and Thailand at the secondary level. Whereas Hong Kong, China and Singapore may be classified as high-income economies, Malaysia and Thailand can be classified as middle-income economies. Thus, in view of the findings pointed out in Section 2 that the contribution of education varies by context and that higher income economies are more likely to have an economic structure which demands a higher proportion of better educated individuals than lower income economies, the relatively low secondary enrollment rates in several of the higher income economies of Asia is some cause for concern.

Finally, consider enrollment rates at the tertiary level of education (Table 4). As may be expected, the enrollment rates for the more developed Newly Industrialized Economies (NIEs, i.e., Hong Kong, China; Korea, Singapore, and Taipei,China) are higher than those of other ADEs with the exception of the Philippines. However, given that the future growth prospects of the NIEs is probably most critically dependent on education at

[5] The predicted values were obtained from cross-country regressions based on 121 countries. The dependent variable is gross enrollment rate at the secondary level and the independent variables include an intercept and a polynomial in per capita income. Series A denotes the predicted enrollment rates from a quadratic form in per capita income while series B denotes those from a cubic form in per capita income. Data is from World Development Indicators (1998).

the highest levels, the large and negative differences between actual and predicted enrollment rates depicted in Figure 2 for Hong Kong, China and Singapore does not bode well.[6]

Unlike basic education, which entails development of basic skills relating to literacy and numeracy, higher education, especially tertiary education, prepares students for more specialized occupations and thereby varies by field of study. For the purposes of developing technological capability, higher education in the natural and applied scientific fields is an obvious necessity. Table 5 presents the enrollments in these fields as a proportion of total tertiary enrollment. An interesting feature of this table is the similarity in this proportion across the more dynamic Southeast Asian economies and the lagging economies of South Asia. Indeed, the relatively low proportions in the scientific fields in these economies relative to the dynamic NIEs is consistent with the finding that Korea and Singapore have around ten times as many R&D scientists and technicians per capita as the other countries in the region and are comparable to the industrial economies in this regard (Table 6).

Table 6 also displays R&D spending as a percentage of GNP for the same cross-section of countries. As is the case with the R&D personnel numbers, the data reveal that the more dynamic Southeast Asian economies do not invest as much in technology related activities as would be suggested by their higher incomes. For example, R&D expenditures in Indonesia, Malaysia, Philippines, and Thailand are much less than those of India or Pakistan.

The Importance of Developing Technological Capability

This section has so far presented some broad indicators of education and

[6] The predicted values were obtained from cross-country regressions based on 109 countries. The dependent variable is gross enrollment rate at the tertiary level and the independent variables include an intercept and a polynomial in per capita income. Series A denotes the predicted enrollment rates from a quadratic form in per capita income while series B denotes those from a cubic form in per capita income. Data is from World Development Indicators (1998).

technology development in the ADEs. Accepting as broadly correct the notion that the human resources required for economic growth depend on the economic context, the section has pointed to deficiencies in basic education among the low income ADEs and deficiencies in higher education and technology development among many higher income ADEs as a potential bottleneck to economic growth. While the importance of basic education as a foundation for economic growth is almost universally acknowledged, what is less appreciated are the critical linkages between higher education and technological capability and economic growth in the context of economic development. For example, the *East Asian Miracle* (World Bank 1993) emphasizes the important role of education, particularly of the basic, in promoting growth in the Asia's high performing economies. While it also emphasizes the importance of technology in promoting that growth, the report essentially focuses on technology acquired through trade (through foreign direct investment (FDI), import of capital goods embodying foreign technology, licensing agreements, foreign training, etc.). Therefore, maintaining openness to foreign technology emerges as the key lesson.

While it is true that foreign technology represents an important opportunity that the ADEs must exploit, it is equally true that the ADEs ignore the development of local technological capabilities at their own peril. Indeed, recent trends in some Southeast Asian economies suggest how important local technological capability can be in sustaining growth. We now consider these trends.

The economic growth experience of Asia's high-performing economies has often been described in terms of the metaphor of the "flying geese". According to this metaphor, as the most technologically advanced country in Asia, Japan, moved away from being an exporter of labor-intensive manufactured goods such as textiles to more high-technology products, the NIEs took its place. Similarly, as the latter set of countries developed more skill-intensive exports, so other Asian countries, essentially Southeast Asian ones, stepped in to fill the vacancy.

At first glance, an economy such as Thailand would seem to be a good example of this process, but a more careful examination suggests that there is cause for concern about its future export, and hence, growth performance. Certainly, Thailand follows the pattern in that it has shown a marked increase in the proportion of its total exports that are manufactured, from 32 percent in 1980 to 80 percent in 1995, with a consequent decline in the share of agricultural exports. Moreover, manufactured exports have shifted away from labor-intensive products to products classified as medium to high technology, so that by 1993 the latter exceeded the former. In 1995-1996 the growth of exports fell well below the average for the preceding four years, but the medium- to high-technology products performed relatively less badly than the other categories.

Why then is there cause for concern? The problem is that the decline in the growth of Thailand's low-technology exports has come from the increasing competition from the low-wage economies of Bangladesh, China, India, and Viet Nam. As the examination of wage rates across ADEs in Table 7 suggests (adapted from Lall, 1998), economies such as Bangladesh, China, India, and Sri Lanka have an advantage over such ADEs as Malaysia, the Philippines, and Thailand in the manufacture of unskilled and semiskilled labor-intensive products. This makes it less likely that the latter group of countries can continue to specialize in traditional manufactured exports in which the primary unit cost advantage stems from low wages and grow as rapidly as they have in the last 10 to 15 years.

All of this would not be serious if it were more than compensated for by sustained growth in the medium- to high-technology exports. Indeed, it could be said to be highly desirable if it reflected increasing sophistication of Thailand's industrial base. However, the crux of the problem is that Thailand is essentially acting as an assembly point for these medium- to high-technology exports (Lall, 1998). Thus while these goods, such as electronics and cars, are classified as medium- to high-technology products, they do not involve a highly skilled labor force for that part of their production that actually takes place in Thailand. Hence, Thailand's production of these exports is likely to come under increasing pressure from the low-wage and unskilled labor economies.

A similar pattern is discernible in the Philippines, where during 1991-1996, electrical and electronic exports increased by 37 percent per year while exports of textiles and garments increased by merely 8.2 percent, the slowest growth rate among all ADEs with the exception of Korea and Taipei,China (World Bank 1997). Unfortunately, electrical and electronics exports of the Philippines have very low value added – a reflection of the fact that the local industry is primarily engaged in the simplest types of assembly and testing activities. For example, the average local content in semiconductors – which accounted for 77 percent of total electronics exports in 1995 – is only about 20 percent. By comparison, Taipei,China has achieved an average local content of about 75 percent in the production of semiconductors (World Bank 1997). Moreover, the local content in the electrical and electronics industry has not increased appreciably in the Philippines during the past two decades, indicating low development of technology and technological capability.

If the process of the hollowing out of the industrial and export base continues, it will spell new difficulties for these economies. Of course, the steep currency devaluations in these economies have given them some breathing space. However, the difficulty is that at the moment, the human resource base to produce those exports where skills are important and that provide a measure of protection from competition from the low-wage, unskilled economies does not exist. While Thailand enjoys almost universal enrollment rates in primary education, its enrollment rates in secondary education remains low and its tertiary education appears to be somewhat biased against basic and applied science. Estimates suggest that Thailand is producing less than two-thirds the number of engineers and scientists with undergraduate and graduate degrees that it requires (Lall 1998), and as Table 5 showed Thailand has a lower proportion of tertiary-level students enrolled in natural and applied scientific fields than such low income ADEs as Bangladesh and India.

Limited local technological capability can also be gleaned from the fact that while Thailand purchases a large amount of technology—as indicated by its payments for foreign patents, copyrights, industrial processes, trademarks, and so on—it receives disproportionately smaller payments from foreigners for the use of its intellectual property than a much lower income ADE such as Pakistan: In 1995 Thailand paid $630 million, but received only $1 million, compared with Pakistan's payment of $12 million and receipt of $2 million (World Development Indicators 1997).

For economies that have lost their competitiveness in the production of semi-skilled labor-intensive goods, regaining competitiveness in the absence of cuts in wage rates will involve either improving productivity in the production of the same goods or moving into the production of new and improved goods. And the latter will entail a greater emphasis on the design, development, and marketing of these goods as opposed to assembly-line operations. However, both options require workforces to upgrade their technological capabilities.

4. Improving Human Resources: Strategies and Policies

Allocation of Resources to Education and Technology Development

Given that the development of human resources, including technological capability, is important for improving productivity and for raising standards of living, one crucial question relates to how it should be financed. The case for public financing of the various human resource development activities must depend on two grounds. The first is the difference between social and private returns across various activities. When this difference is positive and large for any particular activity, the decisions of private individuals will lead naturally to an underinvestment in that activity from the point of view of a social optimum. Education generally falls into this category as it is believed to bring substantial benefits to society as a whole, and not just to those individuals who receive it. That is, education has a significant positive externality.

While activities geared toward the creation of new technologies such as R&D can reap substantial benefits to those conducting them – and this is precisely why profit seeking firms conduct R&D – such activities can nonetheless benefit others as well. That is, the social returns can exceed the private returns. This happens because the knowledge developed as a result of R&D activities is difficult to appropriate completely by those carrying it out. Others can also derive benefits by virtue of imitation and reverse engineering. To the extent that this takes place, the market will undersupply them relative to the social optimum. Additionally, relying excessively on imports of new technology can reinforce the tendency for undersupply of R&D. Importing technology represents a very important opportunity for the ADEs - estimates from Indian firms reveal that the internal rates of returns from licensed import of technology were typically three times as much as from in-house R&D (Basant and Fikkert 1996, Hasan 1997). However, to some extent such imports will substitute for local efforts (Fikkert 1997, Lee 1997) and over time this can have adverse consequences for domestic technological capability.

The second justification for public financing is on grounds of equity and income distribution. In the case of education, for example, if it is left entirely to private financing, the poor and disadvantaged are likely to be denied access to it. Even though poor people may wish to partake of education in the knowledge that this would greatly enhance their future earnings, they may have no way to pay for it. Typically, future earnings cannot be used as collateral for a loan, and so they cannot borrow against the stream of future incomes to pay for the education. The situation is similar with R&D. R&D activities are typically quite costly, and generally involve substantial outlays up front (for example, in setting up a well equipped laboratory). While the costs of carrying out R&D may be sufficiently recouped through higher profits over time, obtaining credit can be a problem, especially for smaller firms. Effectively, these firms are denied the opportunity of conducting R&D.

In principle, therefore, there is a case for public financing of both education and technology development.[7] However, in the face of limited public sector budgets, choices have to be made regarding which activities deserve the support of public finances and to what extent. In the ensuing discussion we first discuss the allocation of resources within the education sector itself. Then, we discuss activities such as R&D, highlighting, in particular, the close links between higher education and research.

A widely held view is that there is ample scope for reallocating public finances toward primary education and away from higher education in many developing economies, particularly those where access to primary education remains a serious problem. What is the rationale for this? First, despite the many difficulties in computing social returns and, therefore, the difference between social and private returns, many believe that these are greater for primary education as opposed to higher education. This view is perhaps best characterized by an illustration in Psacharopoulos (1996): the probability that higher education leads through research to a life-saving breakthrough is very small. On the other hand, lack of schooling guarantees illiteracy which in turn is very likely to result in high transactions costs for the rest of the economy. Second, students enrolled in higher education can typically afford to pay for it (or a large part thereof).

On the basis of these arguments it would seem optimal for the low income ADEs to

[7] Khan and Thorbecke (1988, 1989) examined the issue of technology choice and diffusion in Indonesia by using a social accounting matrix (SAM) based model. Their work demonstrates that even for labor-intensive techniques learning and skill are important. There are also linkage effects that are economy wide. Based on their findings a strong case can be made for the benefits of public financing of education and some types of technology.

focus on their provision of primary education. As noted in Section 3, the primary sectors of the many low-income ADEs, especially those in South Asia, suffer from a number of serious problems of access and quality that could, in principle, be tackled through the allocation of more resources toward it. Yet, many of these economies tend to underemphasize their primary education sectors relative to their secondary and tertiary sectors. This can be seen in several ways. Because an examination of spending per student across primary and secondary sectors may be misleading as an indicator of a country's relative priorities – teaching inputs, including teacher services, cost more for higher levels of education – one can examine the ratio of spending per student in primary versus secondary education *across* the ADEs. As Mingat (1995) notes, the value of this ratio for four South Asia countries (Bangladesh, India, Pakistan, and Sri Lanka) and China is on average 0.40. In contrast, the ratio for both the ASEAN-4 and the NIEs is on average 0.70 and 0.71, respectively. Thus, in comparison to economies which tend to be much better off both economically and in terms of educational attainments, these low-income economies do not seem to prioritize the provision of primary education.

Similarly, one can compare pupil-teacher ratios across levels and ADEs to get some sense of the relative importance of primary education in some low-income ADEs. As computed by Mingat (1995), the "Asian means" for pupil-teacher ratios were 31, 23, and 18 at the primary, secondary, and tertiary levels respectively.[8] The largest deviations from these means is in the case of primary education for three South Asian economies, Bangladesh, India, and Pakistan. For example, whereas the pupil-teacher ratios in Bangladesh at the secondary and tertiary levels were 27 and 19, respectively, and therefore not too far from the "Asian means", it was 64 at the primary level – more than double the mean pupil-teacher ratio![9]

[8] The countries included were: ASEAN-4, NIEs, Japan, China, and four South Asian economies (Bangladesh, India, Pakistan, and Sri Lanka).

[9] The numbers for India and Pakistan were 48 and 25 and 41 and 19 at the primary and secondary levels, respectively (the ratios were not available at the tertiary level). The ratios for China and Sri Lanka - two economies which "under-invested" in primary education relative to other economies according to the

Thus, in comparison with other Asian economies, especially the better performing ones of East and Southeast Asia, South Asian countries such as Bangladesh, India, Nepal, and Pakistan seem to devote fewer resources to the primary sector relative to higher levels. At the same time, they also have the poorest performance in terms of enrollments and student retention rates suggesting strongly that relative neglect of primary education is responsible for its inadequacy.

It has to be admitted that in the absence of reliable estimates of social returns from investments at various levels of education it is impossible to rule out the possibility that South Asia's relative neglect of its primary education in favor of higher education has not been imprudent.[10] However, the micro-evidence on the relationship between returns from education and economic context described in Section 2 strongly suggests that at low levels of income, economies would be well advised to focus on providing primary education of adequate quality. This is reinforced by the macro evidence of Mingat and Tan (1996) described briefly in Section 2. In fact, as Mingat and Tan (1996) point out, if it is assumed that "all the benefits from investing in education get internalized in the performance of an economy over the medium-term," it is possible to interpret the coefficients on enrollment rates at the three levels of education in their cross-country growth regressions as social benefits. Social returns may then be derived by comparing the social benefits with social costs of education which Mingat and Tan compute by including not only the direct public and private costs of education but also estimates of the foregone earnings or production as a result of school attendance. Their results indicate that the highest social returns to education for low-income countries (those whose per capita GDP was 20 percent or less of the United States in 1960) stem from expanding primary education. For middle (per capita income between 20 and 40 percent of the United States in 1960) and high income economies (per capita income greater than 40 percent of the US in 1960), it is the

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first criteria considered here - were *lower* than the Asian means at all three levels of education.

[10] Moreover, arguments such as Psacharopulous above are based on heuristics.

expansion of secondary and tertiary education, respectively, that result in the highest returns. When combined with the fact that a large number of children in the low-income ADEs continue to be denied the opportunity to acquire decent literacy and numeracy skills, these numbers do make a compelling case for a reallocation of public financing toward basic education in these economies .

At the same time, the implications of the above evidence are clear for the higher income economies of Asia which have been able to provide greater access to primary education than their South Asian neighbors. These economies cannot afford to rest on their laurels. As their economies have developed, sustaining future growth requires greater skills and knowledge. Yet, as all of the evidence in Section 3 suggests, particularly for the high performing Southeast Asian economies, the current systems of education have not delivered the required skills and knowledge. In part, it is a reflection of market failures of the types mentioned at the beginning of this section.

This is not to suggest that public resources be used to provide blanket subsidization for higher education. In the first place, it is important to distinguish, as does Birdsall (1996), between the various types of higher education. Not all of higher education involves research and research-based training, activities for which there could be important externalities for society. In fact, much of higher education involves the training of students for relatively well paid professional functions. The appropriate role of the government in so far as the latter group of functions of higher education are concerned is to ensure an effective loans and scholarship program to complement user fees. Direct subsidies should essentially be reserved for research and research-based training that have important externalities. Moreover, these subsidies should be channeled in the form of research grants to departments which are active in research.

In addition to subsidizing research activities in institutes of higher learning, it is possible for governments to promote research activities by supporting special institutions that facilitate the development of technologies which the private sector can use. This is because in addition to the externality and credit constraints noted above, less developed economies lack the critical mass of researchers that individual firms would require for successful technology development. Thus, in Korea, for example, government research institutes took the lead in technological activities initially, with the private industry taking a supporting role (Deolalikar 1997). To promote applied research for industries, in 1966 the government established the Korean Institute of Science and Technology. In its early years, the institute devoted its attention to the relatively simple problems associated with technology transfer and absorption. In the 1970s the government decided to set up a number of other specialized research institutes, essentially an offshoot from the institute, in a number of fields, including machinery, metals, electronics, nuclear energy, resources, chemicals, telecommunications, standards, shipbuilding, and marine sciences. By the end of the 1970s Korea had at least16 R&D institutions (many of which were later consolidated under the Ministry of Science and Technology). Similarly in Taipei,China, government research institutes initiated a system of extension and contract research to provide technological support for private industry (Deolalikar 1997).

It is important to note that in their efforts to develop local technological capability, R&D institutions in both economies worked closely with the private sectors and were not meant to substitute private efforts but rather nurture them. Thus, whereas the Korean government accounted for nearly three quarters of the national R&D expenditures in the early 1970s, 80 percent of R&D expenditures were borne by the private sector by the early 1990s (Deolalikar 1997). Similar technology and R&D institutions in India have not worked as well, because they did not foster close partnerships with industry. As a result, these institutions have produced research and technologies that have not found many applications in industry.

In addition to fostering fruitful partnerships between the public and private sectors, the technology policies followed in both Korea and Taipei,China simultaneously encouraged the import of technology and developed local technology and technological capability. By contrast, the Government of India's policy regarding the import of technology (whether by import of physical inputs such as equipment embodying foreign technology or by licensed transfer of technological know-how) was chiefly concerned with conserving foreign exchange. While in and of itself this may not have been an imprudent concern, the policy was implemented by an across-the-board attempt at developing locally what could be imported by installing a stringent import licensing regime which worked in tandem with some of the highest tariff rates in the world. By disregarding comparative advantage to such an extent and spreading meager research resources too thinly, India managed to not develop export competitiveness in virtually any knowledge-based industry. Interestingly, India's very recent success in software exports –exports in 1995-96 were $2.5 billion – has come about alongside greater market orientation in its economy and facilitative government policy towards this niche market.[11]

The foregoing has examined broadly the question of which kinds of investments in human capital deserve greatest attention in the allocation of public resources. In a nutshell, the answer has been that it depends on the economic context of a particular country. Expansion of primary education makes greatest sense for the low income economies which are striving to make a breakthrough in manufacturing and improve agricultural productivity. On the other hand, the higher income economies simply cannot afford to neglect higher levels of education and research activities related to technology development as some seem have to done.

Reforming the Education Sector

Making appropriate investments in human resources is not a question of simply

[11] Of course, the enormous growth in the information technology industry in the US and Europe has been of critical importance. However, without greater market orientation and, therefore, sensitivity towards demand, it is doubtful that India's software industry would have developed in the manner that it has.

allocating more resources to the appropriate levels of education. Indeed, this point is implicit in the above discussion of partnerships between the public and private sectors in research activities, where striking the right balance can lead to high payoffs. In fact, it has been argued that a fundamental change in the institutional setting, including the incentive structures, under which the education sector, in particular, currently operates is needed.

As mentioned before, the education sector has expanded tremendously in most ADEs over the last three decades. Much of this expansion, particularly at the lower levels of education, has taken place under government finance and provision. Nevertheless, as also mentioned before, in many circumstances the quality of education being delivered leaves much to be desired. On the one hand, the problems of quality have to do with curricula. Especially at higher levels of education such as at the senior secondary and tertiary levels, there is concern in many ADEs that current curricula do not emphasize scientific knowledge enough or are not developing the skills valued by the private sector. On the other hand, where there seems to be consensus on what constitutes an appropriate curriculum (for example, developing basic literacy and numeracy skills at the primary level), there is concern that schools are not being able to deliver it.

One answer to these problems may lie in greater decentralization and market orientation of education. In addition to alleviating strained public sector resources, greater decentralization and market orientation may be needed to overhaul the incentive structures of educational institutions and teachers for making the education sector more effective. In particular, when combined with a student loan and scholarship program to mitigate tendencies towards inequity, increasing the extent of decentralized management and finance (including private finance) in education can provide greater incentives for utilizing resources more efficiently at the level of the individual educational institutions and delivering better quality. Additionally, they can create incentives for ensuring that curriculums suit the needs of labor markets.

Testing whether greater decentralization and market orientation improve both efficiency and quality is not easy. For example, comparing test scores (a measure of education quality) across public and private schools while controlling for costs and enrollments is not too helpful. Even if a positive association between private schooling and test scores were to be found, this does not imply that it is private schooling per-se which is responsible for their better performance. If students with greater ability or from privileged homes choose to attend private schools then one would find private schools to perform better holding all else equal. More generally, whenever there is sample selection, i.e., children select between different school types in a non-random fashion based on their unobserved characteristics, simple associations cannot not be taken to have causal interpretations. For drawing policy implications it is critical to control for sample selection when comparing schooling outcomes across school types.

Studies which attempt to control for sample selection, such as Jimenez and Lockheed (1995) (for Thailand, Philippines, Colombia, Tanzania, and the Dominican Republic) and Kingdon (1996) (for Uttar Pradesh state in India), find that private schools tend to deliver higher academic quality at comparable if not lower costs. Similarly, James, King, and Suryadi (1996) find that in primary schools in Indonesia, private funding improves the efficiency of schools regardless of whether the schools are publicly or privately managed.[12] Additionally, private management achieves higher academic quality at comparable costs.

However, these studies have been subject to some criticisms. For example, as pointed out by Colclough (1996), private and public schools may not be homogenous and comparable categories. The sample of private and public schools may specialize in different curricula (academic versus typically more costly vocational education).

[12] This result stands even when the potential endogeneity of source of funding is taken into account. For example, it could be the case that the central government allocates a greater proportion of its total funds to disadvantage communities which also typically lack the capacity to attract more capable teachers and headmasters.

Alternatively, there may be important locational differences (rural schools can be costly on a per student basis because of low population density; a disproportionately large public sector share in such areas could superficially suggest that public schools are less effective in terms of both quality and efficiency). Moreover, at least one study contradicts the general flavor of the findings above that private schools are more effective than their public school counterparts: Bashir (1997) finds that in primary schools in Tamil Nadu state in India, fully-private schools were the least cost-effective whereas government-aided schools were the most cost-effective. Fully-government schools were the intermediate case.

Clearly, more careful research is needed, particularly on *explaining* the differences in cost effectiveness when these seem to be genuinely there. One reason for the differences in cost effectiveness may be that headmasters in private schools typically have greater control on school-level decisions such as selection and utilization of teachers and their services, choice of textbooks, adaptation of curriculum, and improvements of instructional practice that influence student outcomes (Jimenez and Lockheed 1995). When coupled with the fact that headmasters in private schools are ultimately accountable to students' parents, they have every incentive to exercise their control on school level decisions in a manner that is compatible with parents' interests.

Evidence to support this comes from a number of sources. In a review of the empirical literature on cost effectiveness of various schooling inputs (including teacher inputs), Pritchett and Filmer (1997) find a tendency for public sector allocation of schooling inputs to be biased toward teacher-related inputs over other pedagogical inputs (such as textbooks). They argue that the pervasiveness of such allocation of resources is only consistent with decision making which gives an overly large weight to teacher welfare. Why should decision makers act in this way? According to the authors, decision makers are cognizant of the fact that teachers vote while books do not. Students and parents may not be well aware of the optimal mix of inputs in the pedagogical process and in any case typically are not organized well enough to influence centralized decision making regarding school inputs.

There are a number of case studies in support of the view that the incentive structure in public schools is inadequately geared toward improving student outcomes. For example, a survey of 15 villages in four districts of Uttar Pradesh by Dreze and Gazdar (1997) revealed teacher absenteeism to be endemic among public primary schools. Worse, even when teachers were present, they were engaged in activities that hardly resembled instruction, prompting Dreze and Gazdar to conclude that schools were essentially "child-minding" centers. Interestingly, parents and local residents were well aware of work-shirking among teachers and perceived this behavior to be one of the fundamental problems with schooling. In contrast, despite the fact that teachers in for-profit private schools were typically poorly paid and less qualified relative to public school teachers, they appeared to be more effective if only because they have to turn up to teach! (Non-profit schools were rare in the sample and in any case were perceived to be well-run.)

Similarly, Duraiswamy, et al (1997) examine differences in management of teachers across different types of schools. In particular, they examine public, government-aided (which account for between 20 to 30 percent of all schools at primary and secondary levels), and private-unaided schools in eight districts of Tamil Nadu state in India. In some cases, salaries of teachers in unaided schools were a quarter of those in public schools. More interestingly, while the salaries of teachers in private-aided schools are paid by the state, the private management of these schools have the option of hiring teachers they deem to be superior (instead of being assigned teachers from the state capital, Chennai). In principle, private-aided schools can fire teachers deemed to be inefficient. Private-aided schools can also fill vacancies and replace absent teachers quickly. In contrast, public schools are much more constrained in all of these dimensions. The finding that districts with a greater percentage of private-aided schools perform better in terms of average performance on state-wide test scores is consistent with the hypothesis that decentralizing management practices within public schools may lead to better schooling outcomes.

Reforming the incentive structure, particularly of public schools and their teachers, to be more responsive to the needs of students and parents may well lead to large payoffs. As the foregoing studies suggest, decentralization and greater market orientation is required. However, these are not panaceas. First, decentralization of finance and market orientation may well lead to growing inequities unless they are combined with effective student loan and scholarship programs for the poor. As is well known administering these efficiently is no easy task. Second, decentralization of management may simply shift "the same old problems" to levels which are less capable of resolving them. Clearly local capabilities, including those of local administrators and headmasters, will be an important deciding factor in the success of decentralization. It could be argued that where local capabilities at monitoring schools are scarce, appropriate incentive systems for teachers could be instituted. For example, teacher motivation is frequently assumed to be a critical factor in determining schooling outcomes; thus, it is often suggested that a portion of teachers' salaries be associated with student performance. In practice, unfortunately, such schemes are rarely successful. Kremer (1995) illustrates the point with reference to Kenya's policy of judging primary schools on the basis of results achieved on a national exam held in the eighth grade. Schools have responded to the incentives, "but the incentives are too narrow": many schools seem to indulge in the practice of allowing only the best students to take the exam while forcing others to repeat the seventh grade. Moreover, such narrowly defined incentives may also encourage cheating and leakages of exam questions.[13]

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[13] The widespread cheating in many public examinations in India led Kingdon (1996) to dismiss the usage of score on such tests in her comparison of public and private schools. Instead she measured student achievements by adapting standardized tests of numeracy and literacy used by Knight and Sabot (1990) and

These caveats are not meant to suggest that decentralization and market orientation of the education sector are not the appropriate direction for the ADEs to head in. In fact, virtually all ADEs are embracing these to some degree. However, these caveats must be kept in mind by policymakers if they are to seriously tackle the myriad problems of the education sector.

5. Concluding Remarks

The past few decades have seen the spectacular growth of a number of Asian economies. These miracle economies have compressed into the length of one generation the process of economic development that took many advanced industrialized countries more than a century to achieve. Notwithstanding the recent financial crisis that has affected some of these Asian economies, the extent of economic and social transformation achieved by these economies remain impressive. However, not all the ADEs have achieved the same degree of success as these miracle economies did. Bangladesh, Myanmar, Nepal, and Viet Nam, for example, are among the world's poorest nations.

The question is whether the current state of human resources is going to act as a building block for or a binding constraint to the future economic growth of the Asian economies. The answer lies in identifying the extent to which investment in human resources can affect growth, and determining the degree to which the less developed ADEs can emulate the NIEs in developing their human resources. A related issue is how much the NIEs should invest in human resources to maintain their spectacular growth rates in the future, and whether or not it is a feasible objective.

A rapid demographic transition, with falling birth and death rates and with the latter preceding the former, especially in the NIEs, has led to a bulge in the proportion of young people in the population that is working its way through the age structure. The NIEs' economic success is attributable in part to an increase in the proportion of workers in the

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designed by the Educational Testing Service, Princeton, New Jersey.

population and to the increased level of savings that resulted from the fast economic growth rates (Asian Development Bank 1998). These factors mutually reinforce each other: high growth leads to high savings, and hence to investment, which in turn further stimulates growth. More recently, Southeast Asia has begun to experience a bulge in its working-age population, and might also benefit from this demographic bonus. Eventually, the same may hold true for South Asia.

However, an increase in the labor force is not by itself a prerequisite for economic growth. It could merely result in higher unemployment and greater poverty. What is crucial in this context is how this resource is enhanced. One of the key elements behind the economic miracle, and one that the relatively less developed Asian countries ignore at their peril, has been the effective use and development of that most fundamental of all resources, the people.

This paper has offered an analysis of the specific problems particular groups of ADEs face. Obviously a single set of policies will not be appropriate for every economy, because different ADEs are in different stages of their development. For low-income ADEs such as Cambodia, Lao PDR, Viet Nam, and those in South Asia, improving the access to and quality of basic education should be the main focus.[14] To the extent that adult illiteracy remains a major problem in these economies, basic literacy programs targeted at illiterate adults will also be needed.

For the middle-income ADEs such as the high performing economies of Southeast Asia, the focus will have to be on improving the access to and quality of higher education, particularly that relating to the scientific and technical fields. Moreover, this focus will need to be supplemented by greater efforts at developing local technological capability; as revealed earlier, the national R&D expenditures as a percentage of GNP of the relatively advanced Southeast Asian economies are well below those of such lower-income ADEs as

[14] Many of these economies are also characterized by high levels of malnutrition and morbidity. In these economies, targeted policies to combat malnutrition and morbidity would have high payoffs in the form of increased agricultural productivity.

India and Pakistan.

For the NIEs, their success at transforming their economies has naturally led them to now aspire to a position of leadership in scientific innovation and technological advances, rather than remain imitators. Hong Kong, China and Singapore, which provide high-technology services in finance, trade, and transport, will require more sophisticated information infrastructure and basic scientific and technological development. To achieve all this calls for further upgrading of tertiary education in general, and of science and technology in particular. This would entail not only making greater investments in research infrastructure in universities, but also establishing an environment to foster creativity through greater administrative flexibility and unfaltering commitment to academic and research excellence.

In the final analysis improved human resources and expanded technological capability are the key to a successful transition to a more sophisticated and prosperous economic structure. Therefore, the ADEs would need to formulate, as in other spheres, the necessary human resource policies and implement them. The need for such actions will be further heightened with increasing globalization which tends to provide bountiful rewards to good policies and to handout ruthless punishments to bad ones.

References

Alderman, H, J. Behrman, D. Ross and R. Sabot (1996). "The return to endogenous human capital Pakistan's rural labor market," Oxford Bulletin of Economics and Statistics, 58, pp. 29-55.

Ashenfelter, O. and A. Krueger (1994). "Estimates of the economic return to schooling from a new sample of twins," American Economic Review, 84(5), pp. 1157-1173.

Asian Development Bank (1998). Asian Development Outlook. Manila

Asian Development Bank (1997). Emerging Asia: Changes and Challenges. Manila

Basant, R. and B. Fikkert (1996). "The Effects of R&D, Foreign Technology Purchase and International and Domestic Spillovers on Productivity in Indian Firms," The Review of Economics and Statistics, vol. 78, 42, pp. 187-199.

Behrman, J. (1996). "Measuring the Effectiveness of Schooling Policies in Developing Countries: Revisiting Issues of Methodology," Economics of Education Review, pp. 345-64, v. 15, no. 4.

Behrman, J. and R. Schneider (1994). "An International Perspective on Schooling Investments in the Last Quarter Century in Some Fast-Growing East and Southeast Asian Countries," Asian Development Review, vol. 12, no. 2, pp. 1-50.

Bashir, S. (1997). "The Cost Effectiveness of Public and Private Schools: Knowledge Gaps, New Research Methodologies, and an Application in India," in C. Colclough edited, Marketizing Education and Health in Developing Countries: Miracle or Mirage? Oxford: Clarendon Press, pp. 124-64.

Birdsall, N. (1996). "Public Spending on Higher Education in Developing Countries: Too Much or Too Little?" Economics of Education Review, vol. 15, no. 4, pp. 407-419.

Bray, M. (1998). "Financing Education in Developing Asia: Patterns, Trends, and Policy Implications," paper prepared for the Asian Development Bank.

Chapman, D. (1998). "Trends, Issues, and Policies in Education Management and Efficiency in Asia," paper prepared for the Asian Development Bank.

Chuard, D. and A. Mingat (1996). "Analysis of Dropout and Student Learning in Primary Education in South Asia," paper written for RETA 5617, Asian Development Bank.

Coclough, C. (1996). "Education and the Market: Which Parts of the Neoliberal Solution are Correct?" World Development, vol. 24, no. 4, pp. 589-610.

Deolalikar, A. (1997). “Human Resource Development and International Competitiveness in Asia,” paper prepared for the Asian Development Bank.

Deolalikar, A. 1988, “Nutrition and Labor Productivity in Agriculture: Wage Equation and Farm Production Function Estimates for Rural India,” The Review of Economics and Statistics 70(3), August.

Deolalikar, A. and R. Evenson, 1989, “Technology Production and Technology Purchase in Indian Industry: An Econometric Analysis,” The Review of Economics and Statistics, November.

Deolalikar, A.. and L. Roller, 1989, “Patenting by Manufacturing Firms in India: Its Production and Impact,” The Journal of Industrial Economics 37(3), March.

Dreze, J. and H. Gazdar (1997). “Uttar Pradesh: The Burden of Inertia,” manuscript.

Duraiswamy, P., E. James, J. Lane, and J.P. Tan (1997). “Is There a Quantity-Quality Tradeoff as Enrollments Increase?” Policy Research Working Paper 1768, World Bank.

Evenson, R. and L. Westphal (1995). “Technological Change and Technology Strategy,” Handbook of Development Economics, Volume III, edited by J. Behrman and T.N. Srinivasan, Elsevier Science.

Fikkert, B. (1997). “An Open or Closed Technology Policy?: The Impacts of International Knowledge Diffusion on Self-Reliance and Productivity in Less Developed Countries,” Working paper at the University of Maryland, College Park.

Foster, A. D. and M. R. Rosenzweig (1996). “Technical Change and Human Capital Returns and Investments: Evidence from the Green Revolution,” American Economic Review, 86 (4), pp. 931-53.

Hanushek, E. (1995). “Interpreting Recent Research on Schooling in Developing Countries,” World Bank Research Observer, pp. 227-46, v. 10, no. 2.

Hasan, R. (1997). “Productivity Growth and Technological Progress in a Reforming Economy: Evidence from India,” unpublished Ph.D. dissertation from University of Maryland, College Park.

International Institute for Management Development (1996). The World Competitiveness Report Yearbook, Lausanne, Switzerland.

James, E., E. King, and A. Suryadi (1996). “Finance, Management, and Costs of Public and Private Schools in Indonesia,” Economics of Education Review, pp. 387-98, v. 15, no. 4.

Jamison, D.T. (1986). "Child Malnutrition and School Performance in China," Journal of Development Economics 20: 299-310.

Jimenez, E. and M. Lockheed (1995). "Public and Private Secondary Education in Developing Countries: A Comparative Study," World Bank Discussion Papers 309.

Khan, H.A. (1998a), Technology Development and Democracy: Limits of National Innovation, Systems in the Age of Postmodernism, Alderhost, U.K.: Edward Elger.

_________ (1998b), The Future of Miracles: Interpreting East Asian Growth, manuscript. University of Denver and EDRC at Asian Development Bank; Denver, U.S.A. and Manila, Philippines.

_________ and Erik Thorbecke (1989), "Macroeconomic Effects of Technology Choice: Multiplier and Structural Path Analysis", Journal of Policy Modeling, 11 (1), pp. 131-59.

_________ (1988) Macroeconomic Effects and Diffusion of Alternative Technologies Within a Social Accounting Matrix Framework: The Case of Indonesia, Aldershot, U.K.: Gower Publishing, Co.

Kingdon, G. (1996). "The Quality and Efficiency of Private and Public Education: A Case Study of Urban India," Oxford Bulletin of Economics and Statistics, pp. 57-83, v. 58.

Knight, J.B. and R. Sabot (1990). Education Skills and Inequality: The East African Natural Experiment, Oxford for World Bank.

Kremer, M. (1995). "Research on Schooling: What We Know and What We Don't," World Bank Research Observer, pp. 247-54, v. 10, no. 2.

Krugman, P. (1994). "The Myth of Asia's Miracle," Foreign Affairs, November/December 62-78

Lall, Sanjaya (1998). "Thailand's Manufacturing Competitiveness: A Preliminary Overview," paper prepared for the Conference on Thailand's Dynamic Economic Recovery and Competitiveness, May 1998, UNCC, Bangkok.

Lee, Jaymin (1996). "Technology imports and R&D efforts of Korean manufacturing firms,: Journal of Development Paper, No. 43, The World Bank.

Mingat, A. (1995). "The Strategy Used by High-Performing Asian Economies in Education: Some Lessons for Developing Countries," paper written for RETA 5617, Asian Development Bank.

Mingat, A. and J.P. Tan (1996). "The Full Social Returns to Education," Human Capital Working Papers, World Bank.

Moock, P.R. and J. L. (1986). "Childhood Malnutrition and Schooling in the Terai Region of Nepal," Journal of Development Economics 20: 33-52.

Murphy, K. M., and A. Shleifer and R. Vishny (1991). "The allocation of talent: Implications for growth," Quarterly Journal of Economics, 106(2), pp. 503-530.

Pritchett, L. and D. Filmer (1997). "What Educational Production Functions Really Show," Policy Research Working Paper 1795, World Bank.

Pritchett, L. (1996). "Where Has All the Education Gone?" Policy Research Working Paper 1581, World Bank.

Psacharopoulos, G. (1996). "Public Spending on Higher Education in Developing Countries: Too Much Rather than Too Little," Economics of Education Review, vol. 15, no. 4, pp. 421-422.

Psacharopoulos, G. (1988). "Education and Development: A Review," World Bank Research Observer, vol 3 (1), pp. 99-116.

Schultz, T.W. (1975). "The Value of the Ability to Deal with Disequilibria," Journal of Economic Literature, 13 (1), pp. 827-46.

Solow, R., (1957). "Technical Change and the Aggregate Production Function," Review of Economics and Statistics 39: 312-20.

Solow, R., (1956). "A Contribution to the Theory of Economic Growth," Quarterly Journal of Economics 70:65-94.

Spence, M. (1976). "Competition in salaries, credentials, and signaling prerequisites for jobs," Quarterly Journal of Economics, 90(1), pp. 51-74.

Strauss, J. (1986). "Does Better Nutrition Raise Farm Productivity?" Journal of Political Economy 94 (2): 297-320.

Tan, J.P. and A. Mingat (1992). "Education in Asia: A Comparative Study of Cost and Financing," World Bank Regional and Sectoral Series.

UNESCO (1995). Database.

UNIDO. Industrial Statistics Database.

United Nations Development Programme (1997). Human Development Report, New

York, Oxford University Press.

World Development Indicators (1998). The World Bank.

World Development Indicators (1997). The World Bank.

World Bank (1997). Philippines: Managing Global Integration, Volume 2 (Background Papers). DRAFT CONFIDENTIAL

World Bank (1993). The East Asian Miracle, Oxford University Press.

Table 1. Adult Literacy Rates, Selected Asian Economies, 1960 and 1995

Economy	1960	1995
NIEs		
Hong Kong, China	70	92
Korea, Rep. of	71	98
Singapore	n.a.	91
Taipei,China	n.a.	n.a.
PRC		82
ASEAN-4		
Indonesia	39 [a]	84
Malaysia	n.a.	84
Philippines	72	95
Thailand	68	94
Other Southeast Asia		
Cambodia	36 [b]	n.a.
Lao PDR	28 [b]	57
Myanmar	n.a.	83
Viet Nam	n.a.	94
South Asia		
Bangladesh	22 [a]	38
India	28 [a]	52
Nepal	9 [a]	28
Pakistan	15 [a]	38
Sri Lanka	75 [c]	90

Notes: [a] 1961
[b] 1962
[c] 1963
n.a. = not available.

Source: United Nations Development Programme, 1997. *Human Development Report 1997*, New York: Oxford University Press.

Table 2. Gross Primary Enrollment Rates, Selected Asian Economies, 1960 and 1992

Economy	1960	1992
NIEs		
Hong Kong, China	91	102
Korea, Rep. of	94	103
Singapore	112	107
Taipei,China	97	100
PRC	58	120
ASEAN-4		
Indonesia	60	114
Malaysia	74	93
Philippines	91	112
Thailand	83	97
Other Southeast Asia		
Cambodia	64	109
Lao PDR	25	104
Myanmar	56	105
Viet Nam	n.a.	101
South Asia		
Bangladesh	47	79
India	42	101
Nepal	10	109
Pakistan	33	48
Sri Lanka	95	105

Note: n.a. = not available.

Source: United Nations Human Development Programme (UNDP), 1997. *Human Development Report 1997*, New York: Oxford University Press; United Nations Educational, Scientific and Cultural Organisation (UNESCO) database.

Table 3. Gross Secondary Enrollment Rates, Selected Asian Economies, 1960 and 1992

Economy	1960	1992
NIEs		
Hong Kong, China	30	n.a.
Korea, Rep. of	27	90
Singapore	32	70
Taipei,China	29	88
PRC	18	54
ASEAN-4		
Indonesia	6	43
Malaysia	17	60
Philippines	26	76
Thailand	12	36
Other Southeast Asia		
Cambodia	3	n.a.
Lao PDR	1	24
Myanmar	10	23
Viet Nam	51	32
South Asia		
Bangladesh	8	20
India	10	49
Nepal	6	35
Pakistan	11	22
Sri Lanka	27	86

Note: n.a. = not available.
Source: United Nations Educational, Scientific, and Cultural Organisation (UNESCO) database.

Table 4. Gross Tertiary Enrollment Rates, Selected Asian Economies, 1960 and 1990

Economy	1960	1990
NIEs		
Hong Kong, China	4	20
Korea, Rep. of	4	42
Singapore	6	22
Taipei,China	4	21
PRC	[a]	2
ASEAN-4		
Indonesia	1	10
Malaysia	1	8
Philippines	12	27
Thailand	2	19
Other Southeast Asia		
Lao PDR	0	1
Myanmar	1	10
Viet Nam	n.a.	2
South Asia		
Bangladesh	1	4
India	2	9
Nepal	1	6
Pakistan	2	3
Sri Lanka	1	9

Notes: [a] below one percent.

n.a. = not available.

Sources: Mingat, A., 1995. "Towards Improving Our Understanding of the Strategy of High Performing Asian Economies in the Education." Paper presented at the Conference on Financing Human Resource Development in Advanced Asian Countries, November 1995, Asian Development, Manila; United Nations Educational, Scientific and Cultural Organisation (UNESCO) database.

Table 5. Enrollment in Natural and Applied Science in Selected Asian Economies, 1992

Economy	Applied and Natural Science Enrollment as Percent of Total Tertiary Enrollment 1992
NIEs	
Hongkong, China	35
Korea, Rep. Of	40
Singapore	
Taipei,China	
PRC	47
ASEAN-4	
Indonesia	22
Malaysia	27
Philippines	26
Thailand	19
Other Southeast Asia	
Lao PDR	45
Myanmar	
Viet Nam	
South Asia	
Bangladesh	25
India	26
Nepal	14
Sri Lanka	34

Source: United Nations Educational, Scientific and Cultural Organisation (UNESCO) database.

Table 6. Status of Research and Development Capabilities, Selected Economies and Years

Economy	R&D scientists and technicians per 1,000 persons	R&D expenditure as a percentage of GNP
NIEs		
Hong Kong, China		
Korea, Rep. Of	2.6	2.8
Singapore	2.2	1.1
Taipei,China		
China, PR	0.3	0.6
ASEAN-4		
Indonesia	0.2	0.2
Malaysia	0.1	0.4
Philippines	0.1	0.1
Thailand	0.2	0.2
Other Southeast Asia		
Lao PDR		
Myanmar		
Viet Nam	0.3	0.4
South Asia		
India	0.1	0.8
Pakistan	0.1	0.9
Sri Lanka	0.2	0.2
Advanced Economies		
Canada	2	1.45
France	3	2.38
Germany	3	2.37
Japan	6	2.88
United States	4	2.44

Source: International Institute for Management Development, 1996. *The World Competitiveness Report Yearbook 1996.* Lausanne, Switzerland; United Nations Development Programme, 1997. *Human Development Report 1997*, New York:Oxford University Press.

Table 7. Annual Wages in Manufacturing (US$), Selected Asian Economies and Years

Economy	1970	1994
NIEs		
Hongkong, China		15,160
Korea, Rep. Of	502	14,295
Singapore		17,794
Taipei,China		14,469
China, PR		340
ASEAN-4		
Indonesia	165	1,001
Malaysia	707	4,555
Philippines	651	2,857
Thailand		4,917
Other Southeast Asia		
Cambodia	249	
Lao PDR		
Myanmar		
Viet Nam		
South Asia		
Bangladesh	315	1,016
India	445	1,269
Pakistan	453	
Sri Lanka		837

Source: United Nations Industrial Development Organisation (UNIDO) Industrial Statistics Database.

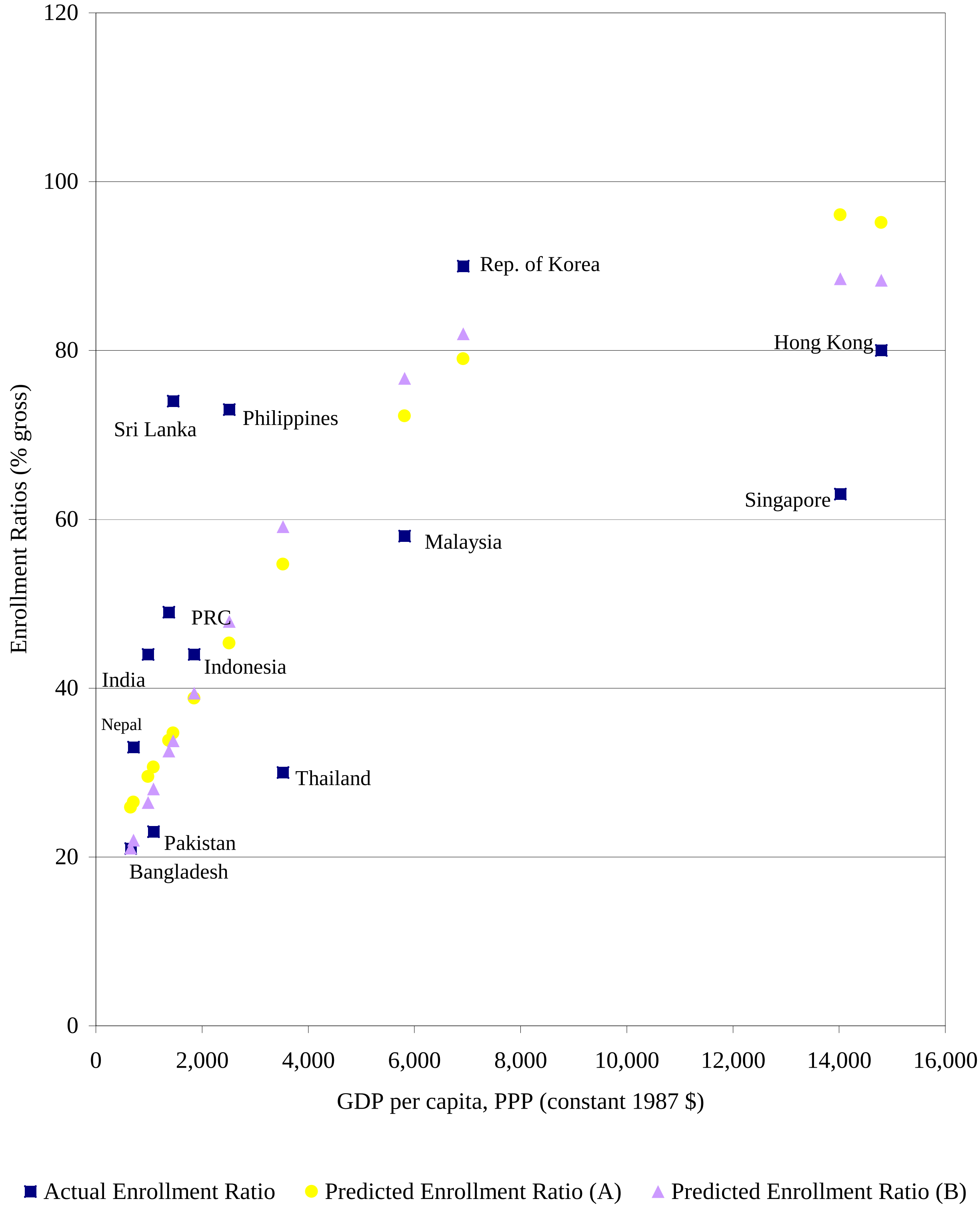
Primary

CTY	PCY	prim enrol	pred1	pred2	pred3	res1	res2	res3
BGD	654.1691	79	87.64581	80.00035	74.51221	-8.64581	-1.00035	4.487795
NPL	708.9567	108	87.71251	80.32813	75.18251	20.28749	27.67187	32.81749
IND	981.7421	97	88.0446	81.93325	78.40098	8.955399	15.06675	18.59902
PAK	1083.055	61	88.16794	82.51799	79.54656	-27.1679	-21.518	-18.5466
CHN	1376.253	127	88.52489	84.17536	82.71309	38.47511	42.82464	44.28691
LKA	1457.087	105	88.6233	84.62319	83.54783	16.3767	20.37681	21.45217
MNG	1791.788	97	89.03077	86.43559	86.83215	7.969232	10.56441	10.16785
IDN	1852.923	115	89.10519	86.75934	87.40261	25.89481	28.24066	27.59739
PHL	2510.49	113	89.90573	90.09937	92.98416	23.09427	22.90063	20.01584
UZB	2535.93	81	89.9367	90.22336	93.18025	-8.9367	-9.22336	-12.1803
KGZ	3039.767	111	90.55008	92.59861	96.77259	20.44992	18.40139	14.22741
THA	3526.758	99	91.14296	94.74915	99.73798	7.857044	4.250852	-0.73798
KAZ	4346.895	87	92.14141	98.04804	103.6866	-5.14141	-11.048	-16.6866
MYS	5816.679	93	93.93075	102.9466	107.8697	-0.93075	-9.94657	-14.8697
KOR	6918.242	105	95.27182	105.765	108.969	9.728181	-0.76495	-3.96903
SGP	14022.88	104	103.9212	106.3864	97.60337	0.078848	-2.38643	6.396628
HKG	14796.39	102	104.8628	104.6191	96.71127	-2.86284	-2.61911	5.288729
KHM	.	118	.	.	.	.	.	.
MMR	.	105	.	.	.	.	.	.
VNM	.	103	.	.	.	.	.	.
LAO	761.0548	.	87.77593	80.63815	75.81245	.	.	.

Secondary

CTY	PCY	sec enrol	pred1	pred2	pred3	res1	res2	res3
BGD	654.1691	21	37.4474	25.86755	21.07083	-16.4474	-4.86755	-0.07083
NPL	708.9567	33	37.67086	26.48697	21.99149	-4.67086	6.513029	11.00851
IND	981.7421	44	38.78351	29.53041	26.45437	5.21649	14.46959	17.54563
PAK	1083.055	23	39.19675	30.64352	28.06114	-16.1968	-7.64352	-5.06114
CHN	1376.253	49	40.39265	33.8122	32.55894	8.607347	15.1878	16.44106
LKA	1457.087	74	40.72236	34.67206	33.75974	33.27764	39.32794	40.24026
IDN	1852.923	44	42.33691	38.79683	39.40023	1.663089	5.20317	4.59977
PHL	2510.49	73	45.01902	45.33391	47.91887	27.98098	27.66609	25.08113
THA	3526.758	30	49.1642	54.66326	59.12086	-19.1642	-24.6633	-29.1209
MYS	5816.679	58	58.5044	72.24137	76.70798	-0.5044	-14.2414	-18.708
KOR	6918.242	90	62.99749	78.99812	81.98681	27.00251	11.00188	8.013192
SGP	14022.88	63	91.97611	96.05948	88.51354	-28.9761	-33.0595	-25.5135
HKG	14796.39	80	95.13113	95.14542	88.32654	-15.1311	-15.1454	-8.32654
KHM	.	.	.	.	.	.	.	.
MMR	.	23	.	.	.	.	.	.
VNM	.	32	.	.	.	.	.	.
LAO	761.0548	.	37.88336	27.07345	22.85937	.	.	.

Figure 1. Actual & Predicted Enrollment Ratios
(Secondary Education)



Tertiary

CTY	PCY	ter enrol	pred1	pred2	pred3	res1	res2	res3
BGD	654.1691	4.4	8.236696	6.097061	2.464046	-3.8367	-1.69706	1.935954
NPL	708.9567	5.2	8.3451	6.272941	2.849726	-3.1451	-1.07294	2.350274
IND	981.7421	6	8.884839	7.141685	4.707214	-2.88484	-1.14168	1.292786
PAK	1083.055	2.9	9.085299	7.461388	5.370868	-6.1853	-4.56139	-2.47087
CHN	1376.253	2.9	9.665425	8.377596	7.213391	-6.76543	-5.4776	-4.31339
LKA	1457.087	4.6	9.825366	8.627841	7.701333	-5.22537	-4.02784	-3.10133
IDN	1852.923	9.2	10.60857	9.838569	9.969343	-1.40857	-0.63857	-0.76934
PHL	2510.49	27.4	11.90965	11.79592	13.31136	15.49035	15.60408	14.08864
THA	3526.758	15.7	13.92046	14.68859	17.52063	1.779545	1.011405	-1.82063
MYS	5816.679	7.2	18.45134	20.61721	23.51379	-11.2513	-13.4172	-16.3138
KOR	6918.242	38.6	20.63091	23.17834	25.09231	17.96909	15.42166	13.50769
SGP	14022.88	18.6	34.68828	35.15823	30.46431	-16.0883	-16.5582	-11.8643
HKG	14796.39	19.4	36.21876	35.98817	31.93695	-16.8188	-16.5882	-12.5369
KHM	.	.	.	.	.	.	.	.
MMR	.	4.3	.	.	.	.	.	.
VNM	.	1.9	.	.	.	.	.	.
LAO	761.0548	.	8.448182	6.439754	3.212528	.	.	.

Figure 2. Actual & Predicted Enrollment Ratios
(Tertiary Education)