Training as a vehicle for enhanced growth: Human Resource Development in Asia-Pacific

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Preface

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I acknowledge the contributions made by attendants of the seminars held to discuss this paper. All remaining errors remain mine.
Lastly, I thank my wife and daughter for keeping me accompanied during their stay.

Kahlil Rowter

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Introduction

Training is everything. The peach was once a bitter almond; cauliflower is nothing but cabbage with a college education [1]

Reference to the need for human resource development is ubiquitous. The amount of attention it now commands is new but the field itself is quite old. And although it probably started when Adam taught Cain the finer points of building a fire, it is still evolving. It is also very broad, potentially covering the whole discourse of how knowledge and skill is transmitted.

The easiest definition of human resource development might be: those efforts that result in better skilled and knowledgeable workers. This delineation is necessary if one is to have a narrow and achievable goal. As one author puts it: "…an entry point into discussion of human resource development is the optimal utilisation of skills, knowledge and experience needed for the production sector such that maximum productivity is achieved. Population control, health, nutrition, political participation and elimination of poverty and illiteracy certainly play important roles in achieving such an objective but widening the discussion to cover them would deflect our focus" [Hongladarom, 1989].

Before human resource development became popular, development was thought to be derived essentially from proper macroeconomic, investment and industrial policies. Although education has always been deemed important, little attention was paid to the direct links with economic development. The thinking goes that given demand from the production sector, a workforce suitable in quality and in sufficient quantity would somehow appear.

The emphasis on human resource development is also the result of the debunking of the assumption that trickle down of benefits would occur spontaneously, or if not, inequitable distribution would be corrected by government policies. The current consensus is that situations with inequitable initial endowment are difficult to correct, especially when clear and transparent property rights are non-existent. As the skill and knowledge of man are his most important assets, enhancing them by means of education and training appears increasingly attractive. This rationale for HRD clearly has its appeals: welfare of the people is after all the goal of any development effort. Furthermore investment in human resources increases labour productivity, and puts the brakes on population growth, alleviates degradation of the environment, plus it also

[1] Mark Twain (1835–1910), U.S. author. Pudd'nhead Wilson, chapter 5, "Pudd'nhead Wilson's Calendar" (1894).

leads to political stability [Streeten, 1995].

The confluence of several factors are responsible for this shift of emphasis. Among others, one can point to the efforts of the World Bank and International Labour Office, the rise in importance of labour economics (especially the influence of the Chicago strand), the rise of the Japanese economy along with its human development ideals, the rising importance of the services sector, the emergence of East Asian economies and the focus of human capital in endogenous growth models.

Problem statement

The scope of this paper will limited to discussing a few interesting questions related to the definition of human resource development above. *First*, **what has economic theory to say about human resource development, especially human capital accumulation**? This is important for the light it can shed on who pays for the accumulation of human capital. The discussion revolves around the market value of training received by workers. If skills accumulated through training has a positive price, then there are two implications. First, firms will probably not want to finance the entire cost of training. Second, workers might be willing to pay for this kind of training, in the form of accepting lower wages during and even after training, with the expectation of recouping it later by re-entering the labour market. The next question is then: what are the proportions of training costs that workers and firms might agree to share? To understand better what the conditions are that give rise to specific training and its associated demand, it is necessary to discuss some basic theoretical developments in human capital that have taken place over the last few decades. Theories are concentrated knowledge and provide guidance as to what warrants attention but also, more importantly, tell us what we do not know.

Second, **what is the connection between human capital accumulation and economic growth**? Is there causality, and if so, which way does it go? The role of human resources development in economic growth has been the subject of numerous studies. Most use cross sections of countries or employ time series on individual countries, especially those at similar levels of development. Why not a combined study of developed and developing countries? The argument against conducting such a study using samples from both groups is fruitless because they are in different stages of development. But point of view assumes no catching up on the part of the less developed countries. One can attempt to fill this gap by constructing a study of several

countries at different stages of development, individually, using the same methodology for all. APEC membership makes for an ideal set as it contains large advanced economies like Japan and the US, smaller advanced ones such as Australia and New Zealand, along with large developing economies like Indonesia and China and smaller ones like Malaysia. It will be constructive to learn how human resource development plays a role in each country and then to compare them.

Third, **what are the implications of modes of human capital acquisition on national human resource policies and on development co-operation among countries**? Related to the first question above, if training is found feasible only with regard to specific skills the implication would be that inculcation of general skills fall on the government's shoulder. If on the other hand the reverse is true, to an extreme, governments need not play any role. Obviously a mix of the two is to be expected. The same question can also be posed when considering the viability of an international training arrangements. Unfortunately, the question of skill transfer is even more difficult to answer than that of specificity of training.

By allocating funds to build training centers governments assume that skills, at least to a large extent, can be transferred outside the workplace. To the other extreme we can conceive programs that rely totally on training inside the workplace. In the real world, a mixture of both is certainly warranted. Yet in many countries across Asia, there is almost exclusive reliance on the former.

Outline and summary of findings

Chapter two lays out the theoretical foundations of the rest of the study in addition to providing insights which are pertinent in their own right. This chapter starts with a definition of human resource development followed by a more detailed discussion on human capital. The application of marginal analysis in human capital investment is among the most important insights to come from labour economics. Whole cottage industries have sprung up to calculate the rate of return on human capital investment, and with varying degrees most have found it to be positive. This is the intellectual basis for a lot of education and training programs, in developing countries, partly due to the advice of multilateral lending agencies but also because of its political appeal, and in developed countries for their underprivileged population segments.

Based on their market value, skills acquired in training can be distinguish into specific and general. When they are perfectly transferable, if any training occurs at all, workers instead of firms will incur their costs entirely. Furthermore, subsidies are shown to increase demand for training even in the face of positive search costs. An

interesting approach introduced by Katz and Ziderman shows that due to informational constraints, general training might not be transferable. This is because full information is only available to the training firm, and recruiting firm must incur positive costs to acquire enough useful information about recruits. In the extreme case returns from training are valued less in the market than in the training firm, which will prevent workers from quitting. Therefore firms lose nothing by investing in general training.

The most interesting question on human capital accumulation from the macroeconomic standpoint is its effect on economic growth. This inquiry has recently acquired a new nuance under the rubric of "new" growth theories. What it does is to open the previously "black box" type of growth determinant called "technical change" to its components one of which is *increase* in the stock of human capital as opposed to just its *level* alone. However, it is impossible to differentiate empirically the roles of level versus growth of human capital in economic growth without a priori conditions. Nevertheless it is now safe to assume that economic growth is affected more by the growth in human capital, and not simply limited to the increase in the number of workers. Economic openness can also play an important role to enhance economic growth by its scale effect, which can be unpacked into learning by doing, human capital accumulation and the positive impact of research and development.

Chapter three sets forth an empirical investigation into the effects of human capital, investment and economic openness on economic growth. This is done using APEC membership as the sample for the period of 1970-1992. The procedure to test the long run relationship is developed first, followed by a description of the data used. The first empirical test shows that human capital accumulation, investment growth and degree of openness have stable long run relationships with economic growth. Another test shows that human capital played important roles in the long term economic growth of Australia, Chile, Japan, Korea, Singapore and Thailand.

The focus in ***chapter four*** is on the best modes of skill transfer and their impact on national as well as international training priorities. Discussions on the fundamentals of skill transfer and survey of empirical findings show that skills can best be imparted through on-the-job training. This concept can be said to underpin Germany's apprenticeship system, among others. Several countries, including Thailand and USA, have adopted the "Dual" system successfully, although not yet on nation-wide bases. Administration, finance and political will are the main obstacles to adoption in other countries. Training agencies can play important roles in increasing the skills of displaced workers and to a lesser extent, for enterprises that cannot afford to set up in-house training.

The main problem facing such systems is that market signals are not being channelled to reform and decision making processes, resulting in training schemes that are seldom catered to the need of employers. This is an additional reason that enterprises, especially larger ones, prefer to train their workers, in-house, off-the-job. To create better links between training institutions, both private and public, employers as the ultimate users of trainees must be involved in the substantive decision making. Some examples show that boards or committees that are in charge of developing numerous particular skills are ineffective. What is needed is one committee per particular skill or craftsmanship. However, in this general decentralisation scheme, a system needs to be developed whereby bureaucracies which might lead to inertia and in-fighting are not created.

If on-the-job training is deemed the best system for skill transfer, the recommendation for national training policy must be that company training should be increased and the German apprenticeship system should be adopted. In terms of development co-operation, one example of on-the-job training for private enterprise stands out: the Association of Overseas Training Scholarship, discussed in ***chapter five***. The institute began with the purpose of promoting exports, servicing Japanese companies overseas as well as other overseas enterprises needing access to training in the use of their Japanese-made equipment. It is now serving a greater audience in which a large part is played by its alumni society, leading to what can be characterised as South-South co-operation originating at the grass-roots.

This model of development co-operation in human resource development is in certain important ways more progressive than the usual modes of building large training centers and then sending trainees to administer them. The indicator of its progressiveness is the very existence of the alumni society and its participation in assisting AOTS in recruiting trainees and conducting overseas training, besides having its own, sometimes international, activities. Even in the face of pressures to reduce development assistance, co-operation in human resource development should be given a higher priority, possibly even at the sacrifice of other forms of assistance. This is because it is human capabilities that count in the final analysis, from the angle of economic as well social and political developments, and not less importantly, from the standpoint of better understanding between nations.

Theoretical underpinnings

The aim of this chapter is to provide the theoretical groundwork for the empirical investigation in chapter three as well as a more detailed discussion on transfer of skill in chapter four. Therefore, this chapter starts with some concepts of human resource development. Next, the standard treatment as well as a new development in training is discussed, followed by a brief description of the role of human capital in economic growth. Lastly, the effect of economic openness is also discussed, as it will be included as one element affecting economic growth, other than accumulation of human capital and investment.

Discussion of terms

It is easy to confuse human resource development, a rather new term with human capital, which has a longer history. In this section a discussion of each will be given.

Human Resource Development

As stated earlier human resources development means something different to different people. It is fruitful to first understand what possible different shades of meaning it might connote. One definition is given by Nadler [Nadler, 1990]: "Human resource development is defined as organised learning experiences in a definite time period to increase the possibility of improving job performance growth." The emphasis is on an *organised* activity as opposed to any casual learning activity that goes on when one reads a newspaper, for example. Furthermore a *limited time period* is necessary to differentiate learning from any increase in ability due to doing a particular job repeatedly for a long time.

Next is the emphasis that the learning activity is actually correlated with an increase in the probability that the ability of the worker increases (as shown in improved performance in his/her job). Without the inclusion of *probability* the definition would not hold water in observing workers whose performances do not improve after development. This inclusion is particularly needed as performance results from many factors, not all of which are controllable. Growth is added to capture the effects that development has beyond the immediate job, to the organisation and to the individual worker. An important delineation of activities within human resource development is: training, education and development. Training pertains to the immediate job; education pertains not to the immediate job but to future (but still identifiable) tasks; and

development does not pertain to any identifiable job but to increasing the potential of the individual worker in general.

Human Capital

This rather ancient concept has found a new meaning in economic literature in the last three decades. Basically it denotes the stock of abilities or skills and productive knowledge that a person possesses. The main difference that human capital has vis-à-vis physical capital lies not so much in their different forms but with regards to differing property rights assigned to each type. Whereas physical capital lends itself easily to purchase and sales, such is not the case with human capital, which is inseparable from the person embodying it. Furthermore it is impossible for a person to sell a legal claim for his/her future earning power. Therefore it is easier to discuss human capital as existing in terms of a rental market. The earliest work which explicitly deals with human capital goes back to Adam Smith [Smith, 1776] where attribution is made to the increased skills of workers specialising in particular tasks.

In the 20th century Schultz and Denison were among the first to attribute "residuals", that part of economic growth unaccounted for by input growth, to the increase in human capital [Denison, 1967], [Schultz, 1981]. Schultz's attribution goes further than education, training and increased literacy to include health, leading to longevity, lowering of the infant mortality rate, and allocation of greater resources to each child. Increasing the stock of health entails investments in child care, nutrition, clothing, housing, medical services and care of oneself.

Becker was primarily responsible for most of the conceptual framework of the study of human capital [Becker, 1975]. His main contribution in the area of the supply of human capital shows that rational economic agents will continue to invest in human capital until its marginal return equals the opportunity cost of funds. Mincerian [Mincer, 1974] earning functions provide proof of this intuition. In many cases earnings profiles of individuals that do not invest in human capital are flatter and have a higher intersection point than those that do invest. The shape of experience-earnings of those that do invest is higher than those that do not invest (after a certain period). This proves that opportunity cost and the cost of investment are recouped by those that do invest.

The main policy application of the human capital corpus has been the provision of basic education and training for economically disadvantaged segments of the population. With the idea that income in a market setting basically reflects possession of endowments, those living below the poverty line are thought to be there for the lack of

sufficient human capital. Therefore the solution is to provide them with a certain amount of resources in the form of education and training. The results, on average, at least in the US do not seem very successful. The main conclusion is that underlying causes of poverty go further than simply the lack of resources for investment in human capital. Other reasons that may account for low investment in human capital are lack of motivation, the existence of discrimination, low ability and low quality of prior education [Ashenfelter, 1978].

As economists use it, the term human capital is defined loosely, whereas in management literature human capital and its augmentation, human resource development are always put is the context of a particular job, a particular human resources system, the firm's internal labour market or in the context of the external labour market [Moore, 1995]. Training forms the most basic approach to increase human capital. A brief exposition of the treatment economic theory has given training will be given next.

Training in human capital models

The issue of training provision by firms revolves around the distinction of training into specific and general types. If the type of training that is feasible is specific then there would be no room for training outside the firm. The most important indicator, wages, will certainly follow different paths under different training schemes. What evidences are available to push the issue to one side or the other?

Becker [Becker, 1975] distinguished training into general and specific training. General training increases transferable skills of workers while specific training is not transportable to other companies. Therefore firms will not pay for general training for the fear of poaching. The basic equations depicting workers' wages with specific training are as follows[2]:

[2] In this section we follow the notations of [Chapman, 1993]

$$w_0 = mp_0$$

(**エラー! スタイルが定義されていません。**.2)

$$R = TC$$

(**エラー! スタイルが定義されていません。**.4)

where w_0 is the initial wage rate, R is the return to the firm giving training, mp_0 is the marginal product of the worker in the initial period and TC is total cost of conducting the training. If we now divide the benefit of training between the worker and the firm according to the parameter λ where $1 \geq l \geq 0$ then

$$R = (1 - l)TC$$

(**エラー! スタイルが定義されていません。**.6)

and

$$w_0 = mp_0 - lTC$$

(**エラー! スタイルが定義されていません。**.8)

In other words, given λ as the share parameter initial wage will depend not only on the worker's productivity but on how much he/she gains privately from training as well.

Without training: w = mp, where w is wage rate of unskilled worker and mp is his/her marginal product. With training in the first period, the cost-benefit equality is

$$mp_0 + mp_1 k = w_0 + TC + kw_1$$

(**エラー! スタイルが定義されていません。**.10)

where mp_0 is again the worker's marginal product initially, mp_1 is his/her marginal product in the first period after training, and k is the discount factor where with r being the discount rate where $k = \frac{1}{1+r}$. Equation **エラー! スタイルが定義されていません。.10** shows that for the firm total benefit equals total cost. With V_{nt} the discounted expected earnings of the worker without training and V_t as the discounted earnings with training, the following will hold:

$$V_{nt} = w(1 + k)$$

(**エラー! スタイルが定義されていません。**.12)

and

$$V_t = w_0 + kw_1$$

(エラー! スタイルが定義されていません。.14)

It is obvious that the worker trains if and only if $V_t \geq V_{nt}$. This condition, then, makes

$k \geq (w - w_0) / (w_1 - w)$ (エラー! スタイルが定義されていません。.16)

If we hold the equality in equation エラー! スタイルが定義されていません。.16 then k^{**} is the critical value of k, at which the marginal worker sits on the fence on whether to train or not.

Next we will discuss the effect of change in training subsidy, t, on the probability that a worker will undergo training. Notations needed here are:

b is the unemployment benefit,

δ is the probability that a trained worker gets a skilled job, and

μ is the probability that an untrained worker gets an unskilled job.

The present value of discounted earnings for workers who do not train is now given by:

$$V_{nt} = (mw + (1-m)b)(1+k)$$

(エラー! スタイルが定義されていません。.18)

For workers who train, their discounted earnings are given by

$V_t = w_0 + k(dw_1 + (1-d)z)$ (エラー! スタイルが定義されていません。.20)

As in equation エラー! スタイルが定義されていません。.16, the worker will only choose to train if and only if

$k \geq (z - w_0) / d(w_1 - z)$ (エラー! スタイルが定義されていません。.22)

Utilising equation エラー! スタイルが定義されていません。**.22** and setting it to equality, and setting w to 1 we get

$k^* = \{m(1-b) + b - t\} / \{d[w_1 - m(1-b)]\}$ (エラー! スタイルが定義されていません。.24)

Taking the total differential of エラー! スタイルが定義されていません。**.24** we get $\frac{dk^*}{dt} = k^*_t / (1 - k^*_m m' - k^*_d d')$, which implies that despite some adjustment due to the search process, increase in training subsidy, t, will result in increase of the amount of training demand. The model discussed so far distinguishes general training from specific training and maintains the feature that firms will finance only specific training, as investment in general training encourages poaching.

In an innovative paper, Katz and Ziderman [Katz, 1990] showed that firms might pay for general training if they have to incur some cost to acquire information about generally trained recruits. Denote V the value in general training. V consists of two components, Z, which is the present value of training for the job it was intended for, and OV, which is the *options value* of the training. OV, has several components, the most important of which is the ability of the worker to handle new or unusual situations. Only the firm which imparts general training to a worker has full information about that particular worker. For a recruiting firm to acquire full information about the worker's ability, especially the options value of the general training it entails costs. These costs can in certain cases be so substantial that recruiting firms might not want to hire a generally trained worker of unknown ability at all. Alternatively the firm might offer employment at the same wage level to a worker with general training and a worker with no training whatsoever. Either of these will prevent movement of a generally trained worker among firms.

V_T denotes the value of the worker with general training to the training firm and V_N, his value to the recruiting firm. The worker's value will decline if he moves from the first to the second firm by $L= V_T - V_N$. If T is the cost of general training, then $T > L= V_T - V_N > 0$.[3] The worker's gain from moving is $(V_T - L)$ but he will lose the contribution he made to his training, which is (T-L). In competitive equilibrium, $(V_T = T)$, therefore the worker's gain from moving is zero. In this setting firms will invest in general training. A discussion on the empirical evidences of general training is given in section 0.

Human capital in growth theories

Starting with the approach of Solow [Solow, 1956] and Denison [Denison, 1967] the following is a brief discussion of the development of growth theories which explicitly include human capital. Consider a differentiated Cobb-Douglas production function which distinguishes labour into two kinds, skilled (with embodied skills that accumulate with education) and unskilled:

[3] [Katz, 1990, p.1153]

$$\dot{y} = \dot{A} + a\dot{K} + b\dot{S} + g\dot{U}$$

(**エラー! スタイルが定義されていません。**.26)

where y is GDP, K is capital, S is the amount of skilled labour and U is the amount of unskilled labour, and the dots denote rate of growth. In practice, to avoid the difficulty in estimating capital, some measure of investment as a portion of GDP is usually used as a proxy. The estimable form of equation **エラー! スタイルが定義されていません。.26** is then:

$$\dot{y} = \dot{A} + a'(I / GDP) + b\dot{S} + g\dot{U}$$

(**エラー! スタイルが定義されていません。**.28)

Mankiw [Mankiw, 1992] refines this estimate by introducing deviations from the steady state in the form of:

$$\dot{y} = \log(A) + a_1 \log(I / GDP) + a_2 \log(H') + a_3 \log(\dot{N}) + a_4 \log(y_0)$$ (**エラー! スタイルが定義されていません。**.30)

where $\dot{y}$ is per-capita GDP growth, H' is human capital per *effective labour* (amount of labour actually used in production), $\dot{N}$ is growth of *effective* labour and y_0 is GDP in the initial period. So far the role of human capital is still derived from its stock.

In a further development, Romer defines the role of human capital in terms of both its stock and growth. Human capital is seen as a decisive factor in development and creation of new material or intellectual "items." Ideas for these new "items" contribute, with investment in R&D, to technical progress on which economic growth depends.[4] His estimating equation is:

$$\dot{y} = a\dot{K} + b\dot{S} + g\dot{U} + (1-a)\dot{A}$$

(**エラー! スタイルが定義されていません。**.32)

Romer then unpacks $\dot{K}$ into $\dot{K} = \dot{K}_a + l\dot{A}$ and $\dot{A}$ into $\dot{A} = \dot{A}_a + h\dot{H} + eH + q(y_0 / y_0^*)$. Putting these factors back into equation **エラー! スタイルが定義されていません。**.32 we get:

$$\dot{y} = a\dot{K}_a + g\dot{N} + l'\dot{A}_a + (b + l'h)\dot{H} + l'eH + l'q(y_0 / y_0^*)$$

(**エラー! スタイルが定義されていません。**.34)

where $l' = 1 - a(1 - l)$.

[4] [Romer, 1986], [Romer, 1990] and citation in [Gemmel, 1995, p.171]

In equation エラー! スタイルが定義されていません。**.34** GDP growth is affected by stock and accumulation of human capital through the parameters h, b and e. The effect of increase in capital productivity is manifested through a. Romer noted that "the empirical implications of the analysis are that the level of a human capital variable like education of scientific talent will be correlated with both the rate of growth of income per-capita and the share of total output devoted to investment in physical capital." Furthermore he states: "It is possible that educational variables will not be significant in a regression for output growth that also includes the rate of investment. If so, the rate of investment should be related to the level of education."[5]

However, the role of human capital stock versus its change in economic growth is still problematic. Gemmel [Gemmel, 1995] maintains that the difference between the models of the Solow-Denison type (エラー! スタイルが定義されていません。**.26** and エラー! スタイルが定義されていません。**.28**) and the Romer type (エラー! スタイルが定義されていません。**.34**) is not in the level versus growth of human capital, but in the interpretation each type makes on the parameters of human capital. This difference cannot be resolved by regression analysis unless prior assumptions are made. An empirical test of this hypothesis will be given in chapter three.

The role of Economic Openness

Studies on the effects of economic openness on trade and investment have been numerous and an attempt to add to such literature will not be done here. One example Edwards [Edwards, 1992] finds positive correlation between growth rates of output and openness of economies. This has been confirmed by [Sengupta, 1991] in the case of Korea. And the World Bank argues the same for ASEAN countries [World_Bank, 1994, p.73].

In standard trade theory it is argued that scale economies and dynamic efficiency in industries where countries specialise in play crucial roles. In new growth theories trade policy affects growth, in the long run, due to its effects on scale economies, which in turn are the combined result of learning by doing along with human capital accumulation and R&D. Therefore the inclusion of some measure of the change in trade orientation is germane. If time series measures of factor endowment can be secured, the proper utilisation of Heckscher-Ohlin model to predict trade flows and hence, its influence on economic growth, can be quantified. Barring such a series we will have to rely on simpler ratios, such as total trade as a fraction of GDP.

[5] Cited in [Gemmel, 1995, p.171]

From the discussions in this chapter it is clear that questions regarding the actual skill accumulation and how it is transferred are not given sufficient treatment in the standard literature. Instead, attention has been focused on costs and benefits of skill accumulation and how human capital accumulation affects economic growth. An attempt to fill this gap is given in chapter four. The next chapter (chapter three) however, will put the ideas of the impact of human capital accumulation on economic growth to its empirical test.

Empirical investigation

This chapter provides an econometric test of the effect that human capital has on long run economic growth. The outline is as follows: first the model is discussed followed by a brief description of the data used. Then the estimation strategy is explored. Next, basic statistics on human capital formation in the sample countries are exposited, followed by the results of the estimation. Finally, a brief comparison with similar studies is given.

The model

The issue that will be investigated revolves around the notion that economic growth is affected by human capital accumulation and degree of economic openness in addition to the more common role of investment:

Income Per-capita = f(Physical capital, Human Capital, Degree of Openness) (**エラー! スタイルが定義されていません。**.36)

To proxy income per-capita in the equation above we use real GDP per-capita (see data description below in section 0). Using GDP per-capita as a measure of welfare has been criticised for its lack of comprehensibility, yet it remains useful from the standpoint of comparability and completeness. The first independent variable, physical capital, is probably one of the most difficult variable to estimate in empirical work. One of the easier proxies is real investment share of GDP, and it will used here. Surrounding the second independent variable are debates about the appropriateness of secondary versus tertiary enrollment ratio that have not been resolved so far. A model including both would be inappropriate from the empirical standpoint that they are highly correlated. Although tertiary level education is closest to Romer's hypothesised definition of human capital, it will not be used here as there are too many missing values for the sample period. As discussed above, there are reasons to believe that *levels* of, as well as *changes* in human capital affect growth. But the inclusion of both in a model where the dependent variable is in levels, unnecessarily complicates derivations of tests for stationarity and the construction of error-correction representations that will be utilised. Therefore secondary enrollment will be used as a proxy of human capital. Export plus import share of GDP will be the proxy for degree of openness.

Therefore the empirical model, in log-linear form, to be estimated is:

$$\log(GDPCAP) = a + b_1 \log(INV2GDP) + b_2 \log(Opennes) + b_3 \log(Enrollment)$$

(エラー! スタイルが定義されていません。.38)

where GDPCAP is GDP per-capita, INV2GDP is the ratio of total investment in GDP, Enrollment is gross enrollment ratios, a is the intercept and e_t, the error term.

Description of Data Used in Estimation

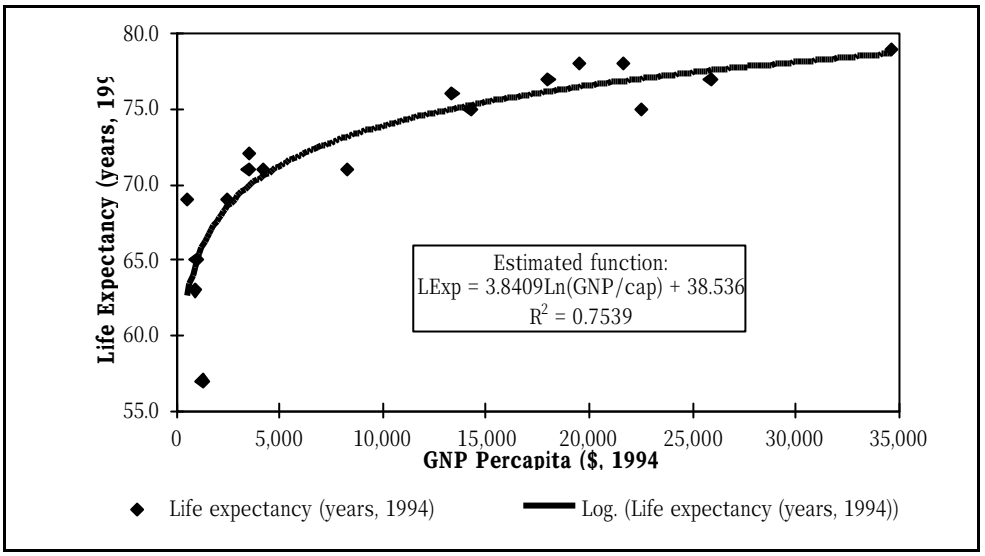
The data used in estimating the equation above is taken from the Penn-World Table version 5.6 (November 20, 1994).[6] Income per-capita (GDPCAP) is in real terms, deflated by current international prices. INV2GDP is real investment as percentage share of GDP also deflated using international prices. OPENNESS is export plus import, both in real terms, deflated by international prices, as a percentage of real GDP. ENROLLMENT is gross secondary enrollment ratios acquired from UNESCO [UNESCO, Various years].

Basic statistics of APEC countries

Table 0-1 presents basic indicators of development in the APEC region, showing wide variations both in size and structure as well as stages in development. Newly industrialised countries having high economic growth include Chinese Taipei, Korea, Singapore and Hong Kong, although other countries are catching up fast, evidenced by robust growth rates of China, Thailand and Indonesia. More advanced countries show less growth although in absolute terms they are already at higher levels of development. The more obvious indicators of human development are also shown in this table, particularly life expectancy and adult illiteracy. As expected, the more highly developed economies also have longer life expectancy rates. The relationship between level of development as indicated by GNP per-capita and life expectancy follows the well-known log function as shown in Figure 1.

[6] Downloaded from www.nber.harvard.edu

Figure 1: Relationship between GNP per-capita and Life Expectancy



Source: [World_Bank, 1995]

Table 0-1: Basic statistics of selected APEC members

	Population (million, 1994)	GNP Percapita ($, 1994)	Av. annual growth (%, 1985-94)	Life expectancy (years, 1994)	Adult Illiteracy (%, 1995)
China	1190.9	530	7.8	69.0	19.0
Indonesia	190.4	880	6.0	63.0	16.0
Philippines	67	950	1.7	65.0	5.0
PNG	4.2	1,240	2.2	57.0	28.0
Thailand	58	2,410	8.6	69.0	6.0
Malaysia	19.7	3,480	5.6	71.0	17.0
Chile	14	3,520	6.5	72.0	5.0
Mexico	88.5	4,180	0.9	71.0	10.0
Korea	44.5	8,260	7.8	71.0	<5
New Zealand	3.5	13,350	0.7	76.0	<5
Australia	17.8	18,000	1.2	77.0	<5
Canada	29.2	19,510	0.3	78.0	<5
Hong Kong	6.1	21,650	5.3	78.0	8.0
Singapore	2.9	22,500	6.1	75.0	9.0
USA	260.6	25,880	1.3	77.0	<5
Japan	125	34,630	3.2	79.0	<5
Brunei	0.28	14,240	n/a	75.0	12.0
Chinese Taipei *	20.7	7,954	7.1	n/a	7.0

Note: *) Population for 1992, GNP/cap, 1991
Source: [World_Bank, 1995]

Table 0-2: Demographic Profile of APEC members

	Population (million, 1994)	Age 15-64 (million, 1994)	Labor Force (Total, million, 1994)	Female in Labor Force (%, 1994)	Labor Force in Agriculture (%, 1990)	Labor Force in Industry (%, 1990)
China	1190.9	800	715	46	72	15
Indonesia	190.4	117	89	40	55	14
Philippines	67	38	27	36	46	15
PNG	4.2	2	2	42	79	7
Thailand	58	39	34	47	64	14
Malaysia	19.7	11	8	36	27	23
Chile	14	9	5	31	19	25
Mexico	88.5	53	35	32	28	24
Korea	44.5	31	21	40	18	35
New Zealand	3.5	2	2	44	10	25
Australia	17.8	12	9	42	6	26
Canada	29.2	20	15	44	3	25
Hong Kong	6.1	4	3	36	1	37
Singapore	2.9	2	1	37	0	36
USA	260.6	171	131	45	3	28
Japan	125	87	66	40	7	34
Brunei *	0.28	0.2	n/a	n/a	n/a	n/a
Chinese Taipei *	20.7	13.9	n/a	n/a	n/a	n/a

Note: * figures for 1991
Source: [PECC, 1994]

APEC membership includes some nations with the largest populations in the world- China, the US and Indonesia. Besides population size, the region also has less developed economies that are undergoing rapid demographic transitions, caused mainly by two interrelated factors: lower birth rates and increasing participation of women in the workforce. Most of these countries have a disproportionately young populations, with large percentages of those under the age of 14. This is especially true for Brunei, Indonesia, Malaysia, Mexico, Philippines and Thailand.

The less developed economies also have higher population growth rates. In other, more developed regions, the populations are ageing and have low growth rates. These differences result in different priorities in terms of human resource planning. For countries with young populations and high growth rates, education and labour absorption are (or should be) high priorities, while for those with ageing populations and low birth rate, the priorities are in insurance and provision of health care for the elderly, and in some cases alleviating labour shortages. For the latter, some countries, like Australia, Canada and the US, utilise immigration, to some extent, to lessen their demographic pressures [PECC, 1994 #68].

Structural changes in the economy that affect the labour market in the APEC region stem mainly from the increasing share of the manufacturing and the services sectors and the

decline of agriculture. The manufacturing and services sectors typically demand professional, administrative, technical and managerial workers, along with other skilled-equipped workers. There is evidence that labour released from agriculture is not being absorbed fast enough. Another observation is that different labour market circumstances in APEC create opportunities for labour flows as well as skills. A PECC study shows the extent of the discrepancies between supply and demand (Table 0-3).

Table 0-3: Estimated Excess supply of Labor in selected APEC members (thousands)

	1994	1995
Australia	10	30
Brunei	0	0
Canada	-60	-40
Chile	20	30
China	4,870	8,480
Chinese Taipei	-40	-80
Hong Kong	-10	-10
Indonesia	700	1,200
Japan	130	200
Korea	450	890
Malaysia	-20	-60
Mexico	150	420
New Zealand	0	0
Philippines	50	80
Singapore	-20	-40
Thailand	-660	-1,430
USA	390	520
Total	5,960	10,190

Source: [PECC, 1994]

In terms of human capital formation, table 3-4 shows that more developed economies in APEC have higher mean years of schooling and higher numbers of scientists (general and R&D) per 1000 persons in comparison with developing members.

Comparing the economic growth, degree of openness and enrollment, from table 3-5, it is evident that developing country members of the APEC grew faster than their more settled, developed members, especially recently. Although the range in growth rates among LDC members is wide, the sample standard deviation is very narrow giving the evidence that most countries' growth rates are not too dissimilar. In terms of investment, early on, developed

countries showed a marked advantage, but since the early nineties less developed member economies have caught up and in some cases even surpassed growth rates of developed economies. Enrollment in less developed economies shows very marked change from an average of 32 percent to 64 percent, while in developed economies it hovers at around 80-90 percent. It certainly is true that increases in enrollment ratios for LCD's are not uniform, as

Table 0-5: Human Capital Formation in APEC members

	Scientists & technicians per 1000 population, average 1986-90	R&D Scientists & technicians per 1000 population, average 1986-91	Science graduates % of all, average 1986-92	Mean year of schooling (+25) 1990
Australia	50	3.3	30	11.5
Brunei	27	6	0	5
Canada	177	3.4	27	12.1
Chile	na	5.7	39	7.5
China	9	na	43	4.8
Chinese Taipei	26	2.9	47	8.5
Hong Kong	41	na	39	7
Indonesia	10	2	11	3.9
Japan	110	6	25	10.7
Korea	47	2.2	29	8.8
Malaysia	na	4	28	5.3
Mexico	na	6	32	4.7
New Zealand	49	na	23	10.4
Philippines	na	1	30	7.4
Singapore	24	1.9	53	3.9
Thailand	1	2	18	3.8
USA	55	na	24	12.3

Source: [PECC, 1994]

evidenced by increased standard deviation and range.

Table 0-7: Comparison of Economic Growth, Degree of Openness and Enrollment Ratios between LDCs and DCs in APEC, 1970-1992

	ALL			5 DCs			10 LDCs		
	Mean	St.Dev	Range	Mean	St.Dev	Range	Mean	St.Dev	Range
Per-capita GDP annual growth	9.4	2.3	7.1	7.8	2.3	2.3	10.2	0.9	7.1
Investment/GDP 1970	22.0	7.1	25.5	26.9	6.3	16.2	19.6	6.2	23.8
1992	27.0	7.2	24	26.4	5.8	15.7	27.3	7.8	24.0
Change 70-92	4.9	6.8	25.2	-0.5	4.0	12.5	7.6	6.3	18.7
Degree of Openness 70	55.3	60.9	219.6	30.4	13.7	37.0	67.7	70.7	219.6
92	90.9	93.3	323	38.4	16.8	42.5	117.1*	104.1	309.3
Change 70-92	33.5	35.5	118.8	8.1	5.3	14.5	46.3	37.3	117.4
Enrollment ratio 1970	48.9	26.1	85.0	82.2	11.8	36.0	32.2	11.0	30.0
1992	74.0	21.4	73.0	94.6	8.0	24.0	63.7	18.4	57.0
Change 70-92	21.5	16.9	64.0	12.4	17.2	51.0	26.1	14.7	61.0

Source: Author's calculation

Notes : 1. Data source is Penn-World Table version 5.6a for GDP, investment ratio and openness (see text for explanation).
2. ALL refers to 15 APEC members: Australia, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Philippines, Singapore, Thailand and USA. The 5 DCs refers to Australia, Canada, Japan, New Zealand and USA. LDCs are the 15 members minus the 5 DCs.
*) Singapore and Hong Kong (and Malaysia since the late 70's) which serve as trade intermediary exhibits (X+M > GDP).]

Estimation Procedure

For estimating time series models, methodology developed in the last two decades has advanced significantly. An important issue that has developed is whether one variable regressed against another is cointegrated. Before discussing cointegration, it is useful to discuss the concept of *integratedness*.

Consider the variable y_t. There are two ways in which y_t can evolve:

(1) $y_t = y_{t-1} + u_t$, or

(2) $y_t = ay_{t-1} + u_t$, $|a|<1$,

where u_t is white-noise.[7] In case of (1) the effect of any change in y_t is permanent in the sense that the change is carried forward indefinitely. On the other hand, in case (2) shocks on y_t will dissipate over time. Model (1) is called Differenced-Stationary (DS) or random walk, while

[7] For a zero-mean, finite-variance stochastic process u_t, in other words $E(u_t)=0$ and $E(u^2_t)$: u_t is white-noise if $E(u_t u_s)=0$ for any $t \neq s$. See [Hendry, 1995, p.39]

model (2) is called Trend-Stationary (TS). If the parameter a in model (2) equals one, it collapses to model (1). Variables that evolve according to DS processes (random walk) are also referred to as integrated of degree 1 or I(1) or non-stationary. Its differenced series, Δy_t is integrated of degree 0 or I(0) and called a stationary series. Most tests of unit root involve a trend term in the following manner:

$$y_t = a_1 + a_2 t + u_t \qquad (\text{エラー! スタイルが定義されていません。}.40)$$

where

$$u_t = bu_{t-1} + e_t \qquad (\text{エラー! スタイルが定義されていません。}.42)$$

where e_t is white-noise. These two equations can be collapsed into:

$$y_t = c_1 + c_2 t + c_3 y_{t-1} + e_t. \qquad (\text{エラー! スタイルが定義されていません。}.44)$$

Investigating for stationarity then involves testing whether c_3 is unitary or otherwise. However the usual t and F tests are not distributed as standard normal and we have to use critical values that have been tabulated by Fuller for white noise e_t. A more general test, where e_t need not be white-noise, the Augmented Dickey-Fuller test, has also been developed.

The concept of stationarity can also be applied to relationships among variables. Let x_t and y_t both be I(1) variables. Next we estimate the equation $y_t = bx_t + e_t$. If e_t is I(0), then x_t and y_t are cointegrated. Generally:

> If x_t is I(m) and y_t I(m) and $e_t = y_t - bx_t$ is I(m-n) and n>0, then x_t and y_t is cointegrated of degree (m,n) denoted CI(m,n).

In the case where x_t and y_t are both I(1) and $e_t = y_t - bx_t$ is I(0) then x_t and y_t will not diverge over time. This is the same as maintaining that x_t and y_t have a long run equilibrium relationship. Conversely if either x_t or y_t is I(1) and the other I(0), the regression is nonsensical, as is the case when both are I(1) but e_t is also I(1), in which case x_t and y_t will diverge over time.

Consider the model:

$$y_t = a_0 + a_1 x_t + u_t \qquad \text{(エラー! スタイルが定義されていません。.46)}$$

$$x_t = b_0 + b_1 y_t + u_t' \qquad \text{(エラー! スタイルが定義されていません。.48)}$$

if x_t and y_t are cointegrated, according to the Granger Representation Theorem, there exists an error-correction mechanism:

$$\Delta y_t = c_0 + c_1 \hat{u}_{t-1} + \sum_{i=1}^{m} c_{2_i} \Delta y_{t-i} + \sum_{j=1}^{m} c_{3_j} \Delta x_{t-j} + e_t \qquad \text{(エラー! スタイルが定義されていません。.50)}$$

$$\Delta x_t = d_0 + d_1 \hat{u}_t' + \sum_{i=1}^{q} d_{2_i} \Delta x_{t-i} + \sum_{j=1}^{r} d_{3_j} \Delta y_{t-j} + e_t' \qquad \text{(エラー! スタイルが定義されていません。.52)}$$

where at least one of c_1 and d_1 is nonzero and e and e' are white-noise. In order for any relationship between two variables to be estimated it is necessary to ascertain its order of integratedness and then check for cointegratedness. c_1 and d_1 can be thought of as speed of adjustment as they are directly related to the characteristic roots of the whole system of equations.

In terms of estimation Stock [Stock, 1987] has shown that the regression of y_t on x_t, in the case where both variables are cointegrated, will converge to the true value of its parameters *faster* than the usual OLS estimation. Whereas in the usual OLS, $\hat{b}$ converges to b at the rate of $\left(1/\sqrt{T}\right)$, in the case of cointegrating vectors it converges at the rate of $(1/T)$ as $T \to \infty$. While this may seem like good news, Phillips [Phillips, 1986] has shown that standard test statistics cannot be used. Therefore OLS, while consistent in terms of estimation, is unusable due to its incorrect test statistics. We therefore rely on the ECM representation (equations **エラー! スタイルが定義されていません。.50** and **エラー! スタイルが定義されていません。.52**). A further check on precedence will also be done both on bivariate and multivariate relations.[8] The usual test for precedence is as follows: x_t is said to precede y_t if in the regression

[8] We prefer the term precedence to Granger-causality for two reasons. First, to economise on language. Secondly to make enable falsification in the Popperian sense.

$$y_t = \sum_{i=1}^{k} a_i y_{t-i} + \sum_{i=1}^{k} b_i x_{t-i} + u_t$$

all β_is are zero [Maddala, 1992, p.393].

We now state the bivariate and multivariate precedence tests on the ECM equations (equations **エラー! スタイルが定義されていません。.50** and **エラー! スタイルが定義されていません。.52**). Consider a model with one dependent variable—y_t, and three independent variables--x_1, x_2 and x_3. After confirming the stationarity of each variable and the cointegratedness of pairs of y on each x, we run an OLS on y as a function of the set of x's, thus acquiring the residual u_t. Next the ECM representation is formulated as follows:

$$\Delta y_t = c_0 + c_1 \hat{u}_{t-1} + \sum_{i=1}^{m} c_{2_i} \Delta y_{t-i} + \sum_{j=1}^{m} c_{3_j} \Delta x_{1_{t-j}} + \sum_{j=1}^{m} c_{4_j} \Delta x_{2_{t-j}} + \sum_{j=1}^{m} c_{5_j} \Delta x_{3_{t-j}} + e_t \quad \text{(エラー! スタイルが定義されていません。.54)}$$

If $c_{3_j} = c_{4_j} = c_{5_j} = 0$ (for j=1 to m) then x_1, x_2 and x_3 do not precede Δy_t. This is not the only ECM equation, in fact there are three more with x_i's as dependent variables. We will only estimate another equation where x_3 (in this case enrollment ratio) is the dependent variable. Precedence tests for investment ratios and openness with each other and the test of economic growth as the cause for increase in the other two variables will not be conducted.

In order to test for multivariate precedence, all of c_3~c_5 need to be checked to ensure they are are no equal to zero. A complete test procedure would swallow up a lot of degrees of freedom (for example, with three x's and m=3, nine degrees of freedom would be subtracted just for the x terms). It is therefore necessary to restrict the lagged x terms, and here they will be restricted to three, and lagged y, to one. Precluded from doing a full multivariate precedence test, a semi-multivariate of the form below is instead proposed:

$$\Delta y_t = c_0 + c_1 u_{t-1} + c_2 \Delta y_{t-1} + \sum_{j=1}^{3} c_{3_j} \Delta x_{1_{t-j}} + c_4 \Delta x_{2\,t-1} + c_5 \Delta x_{3_{t-1}} + e_t \quad \text{(エラー! スタイルが定義されていません。.56)}$$

and testing for $c_{3i}=c_4=c_5=0$ (for i=1 to 3). For each variable LINV, LOPEN and LENROL, an estimate will be run with three lags and the others, with one lag. To be precise these are the three equations that will be estimated:

$$\Delta LGDP_t = c_0 + c_1 u_{t-1} + c_2 \Delta LGDP_{t-1} + c_{31} \Delta LINV_{t-1} + c_{32} \Delta LINV_{t-2} + c_{33} \Delta LINV_{t-3} + c_4 \Delta LOPEN_{t-1} + c_5 \Delta LENROL_{t-1} + e_{t_1} \quad \text{(エラー!}$$

ー! スタイルが定義されていません。.58)

$$\Delta LGDP_t = c_0 + c_1 u_{t-1} + c_2 \Delta LGDP_{t-1} + c_3 \Delta LINV_{t-1} + c_{41} \Delta LOPEN_{t-1} + c_{42} \Delta LOPEN_{t-2} + c_{43} \Delta LOPEN_{t-3} + c_5 \Delta LENROL_{t-1} + e_{t2}$$ (**エラ**

ー! スタイルが定義されていません。.60)

$$\Delta LGDP_t = c_0 + c_1 u_{t-1} + c_2 \Delta LGDP_{t-1} + c_3 \Delta LINV_{t-1} + c_4 \Delta LOPEN_{t-1} + c_{51} \Delta LENROL_{t-1} + c_{52} \Delta LENROL_{t-2} + c_{53} \Delta LENROL_{t-3} + e_{t3}$$ (**エラ**

ー! スタイルが定義されていません。.62)

The following equation is to test precedence of economic growth on enrollment:

$$\Delta LENROL_t = d_0 + d_1 u_{t-1} + d_{21} \Delta LGDP_{t-1} + d_{22} \Delta LGDP_{t-2} + d_{23} \Delta LGDP_{t-3} + d_3 \Delta LINV_{t-1} + d_4 \Delta LOPEN_{t-1} + d_5 \Delta LENROL_{t-1} + e_{t3}$$ (**エラー! スタ**

イルが定義されていません。.64)

Estimation results

Stationarity tests

As stated earlier we will first discuss the stationarity of variables to be used in establishing the relationship of human capital to economic growth. This is done by testing the hypothesis that c_3=1 in equation **エラー! スタイルが定義されていません。**.44 (Table 0-8).

It is apparent that we have to reject the null hypothesis (that c_3 is 1) for all countries' differenced series (at least at 10 percent for all and 5 percent for some). Therefore for

Table 0-8: Augmented Dickey-Fuller tests for Level and Differenced Series

	Levels				First difference				MacKinnon Critical Values		
	LGDP	LINV	LOPEN	LENROL	LGDP	LINV	LOPEN	LENROL	1%	5%	10%
Australia	-3.18	-2.34	-1.60	-3.37	-2.77	-5.74	-5.13	-5.43	-3.79	-3.01	-2.65
Canada	-4.38	-1.72	-2.45	-1.46	-2.02	-5.08	-3.30	-7.29			
Chile	0.39	-2.12	-2.60	-1.91	-3.26	-7.72	-2.70	-3.87			
China	-0.97	-1.88	-1.84	-1.73	-3.85	-4.76	-3.00	-5.78			
Hong Kong	-3.79	-1.47	0.71	-3.37	-2.98	-3.46	-5.42	-4.96			
Indonesia	-2.58	-2.13	-2.79	-2.25	-2.21	-6.00	-3.97	-4.37			
Japan	-2.92	-1.11	-1.57	-0.77	-2.61	-2.77	-3.91	-8.53			
Korea	-0.55	-0.90	-3.81	-1.55	-4.34	-4.03	-3.19	-5.42			
Malaysia	-1.75	-1.51	-0.44	-1.76	-4.65	-3.66	-4.11	-3.69			
Mexico	-2.04	-1.55	-1.18	-1.83	-2.96	-3.35	-4.52	-6.26			
New Zealand	-2.71	-2.99	-2.40	-0.01	-3.30	-5.35	-3.71	-4.02			
Philippines	-2.92	-1.77	-1.09	-1.04	-2.81	-3.10	-4.05	-6.57			
Singapore	-2.66	-2.40	-2.84	-0.95	-2.72	-5.08	-3.60	-4.27			
Thailand	-1.00	-0.02	-0.74	-1.45	-3.23	-4.34	-4.26	-7.43			
USA	-3.96	-3.55	-2.89	-1.57	-2.85	-5.32	-3.39	-6.14			

Note: The estimating equation is $D(X_t)=a+b.X_{t-1}$, where D is the difference operator.

all countries, level variables are I(1). This suffices for the necessary condition for any two or more variables to be cointegrated. In the next section, tests for pairs of variables for the requirement of being cointegrated are discussed.

Bivariate cointegration test

Next we calculate the bivariate cointegration using the Engle-Granger Cointegration test (where differenced error from OLS of the two variables is regressed on lagged errors). The hypothesis to be tested here is that both series are I(1) and the resulting error on regressing them is I(0). The resulting calculations are given in Table 0-10.

For most countries it is impossible to reject the hypothesis at 1 or 5 percents and a few at 10 percent. Note that we expect most advanced countries in the set to show large test values for the LGDP and LENROL pair, as these countries already had high enrollment rates even prior to the start of the analysis period, 1970. These high rates mean that there is little in way of variations on the enrollment series. Therefore the residuals will reflect more of GDP fluctuations than variations in what is left after we subtract enrollment variations from GDP variations.

For Australia, we cannot reject the hypothesis that LGDP and LOPEN are cointegrated of degree 1 as shown by the test for LGDP = f(LOPEN). Such is also the case for LGDP with LENROL. In the cases of LGDP and LINV, we see that both LGDP = f(LINV) and LINV = f(LGDP) have residuals that are I(0).

For Canada, both LGDP on either LOPEN or LINV show residuals of I(0). In the cases of LGDP and LENROL, LGDP as a function of LENROL is marginally accepted at 10 percent and the reverse is rejected even at 5 percent. Therefore there is some evidence that the two series are weakly cointegrated.

For Chile, with the exception of LINV on LGDP, all other pairs' tests cannot reject the hypothesis that both series are I(1) and residuals on regressing them are I(0).

For China and Hong Kong, all pairs' tests cannot reject the hypothesis.

For Indonesia, we can reject the hypothesis for the LINV-LGDP pair at 5 and 10 percent, but we cannot do so at 1 percent. There is, therefore, some evidence that investment and economic growth may not have the same fluctuations. On the other hand we cannot discount the fact that there might be either noise in the investment and GDP data, or that either series was subject to smoothing by the statistical agency.

For Japan, with the exception of enrollment where we can reject the hypothesis at 10 percent, for all other pairs we cannot do so. This also reflects that for Japan which had already had a high enrollment ratio since the beginning of the period under study and therefore has had very little variation in its series, it is natural to expect the data not to strongly suggest long run convergence. Of course, if we did the same test for longer

periods the results would look different.

For Korea, Malaysia, Mexico, Philippines and marginally for New Zealand, all tests values indicate that we cannot reject the null hypothesis.

For Singapore and Thailand, the ability to reject the hypothesis, even at 10 percent is rather puzzling given that both countries had low enrollment rates at the beginning of the estimation period, especially Thailand. We can only speculate that either one or a combination of three factors came into play. First, that there was a break in the series; second, smoothing was done on the GDP series; third, the noise in enrollment ratios is especially significant (due in a large part by the number of repeat students, as we are using gross enrollment).

For the US, we can reject the hypothesis for the LGDP and LENROL pair at 10 percent, and it is not puzzling given the argument above.

We therefore have to accept that the relationship between GDP and the other variables goes both ways. Several caveats regarding these results are worth noting. First, small sample size can affect the failure to reject the hypothesis. Second, the power of the test is biased against accepting the alternative hypothesis. Third, a structural break in the series can prevent rejection of the null hypothesis. We will consider next if the residuals of OLS of the regressors (LINV, LOPEN and LENROL) on LGDP are indeed I(0).

Table 0-10: Engle-Granger bivariate cointegration test (with constant, no lag)

	DF t statistics						MacKinnon critical values		
	LGDP on LOPEN	LOPEN on LGDP	LGDP on LINV	LINV on LGDP	LGDP on LENROL	LENROL on LGDP	1%	5%	10%
Australia	-2.04	-3.42	-2.04	-3.14	-0.77	-3.39	-4.47	-3.64	-3.25
Canada	-1.77	-2.66	-1.96	-2.39	-3.1	-3.84			
Chile	-1.14	-2.42	-3.12	-4.46	-1.12	-1.64			
China	-2.04	-2.54	-1.65	-2.5	-1.84	-2.64			
Hong Kong	-2.67	-1.59	-0.6	-1.5	-2.33	-2.57			
Indonesia	-1.18	-2.35	-3.45	-4.11	-2.31	-2.5			
Japan	-1.41	-1.91	-0.34	-1.09	-4.25	-3.33			
Korea	0.3	-2	-1.86	-2.07	-0.89	-1.43			
Malaysia	-2.01	-1.76	-1.82	-2.22	-1.63	-2.22			
Mexico	-2.5	-2.31	-1.59	-1.88	-2.12	-2.59			
New Zealand	-0.6	-2.01	-1.09	-3.12	-2.58	-2.63			
Philippines	-1.83	-1.83	-0.94	-1.59	-1.43	-1.18			
Singapore	-0.36	-1.77	-0.64	-2.46	-3.66	-3.75			
Thailand	-1.88	-1.99	-1.8	-1.12	-2.35	-3.58			
USA	-1.33	-2.22	-1	-3.65	-3.44	-3.79			

Note: The estimating equation is $D(Residual)=a + b.Resid_{-1}$ where Residual is the residual of the regression of x on y and D is the difference operator

Stationarity test on residuals

As stated earlier the next step is to test the degree of integratedness of the residuals from OLS on the function LGDP = f(LINV, LOPEN, LENROL). This is done for lags of three periods. The resulting calculation is given in Table 0-13. Most test values reject the null hypothesis that there is unit root. We therefore have to accept the alternative hypothesis that the residuals are I(0) which fulfils the second necessary condition that the regression is not spurious.

Table 0-13: Stationarity test on residual from OLS

	ADF t statistics					MacKinnon critical values			
	Lags					Lags			
	0	1	2	3		0	1	2	3
Australia	-2.82	-2.39	-2.43	-2.46	1%	-2.68	-2.68	-2.69	-2.7
Canada	-2.98	-2.19	-2.02	-1.61	5%	-1.96	-1.96	-1.96	-1.96
Chile	-1.79	-2.53	-2.56	-2.13	10%	-1.62	-1.62	-1.62	-1.63
China	-2.29	-2.82	-2.2	-1.55					
Hong Kong	-2.15	-2.17	-2.23	-2.22					
Indonesia	-2.86	-2.73	-2.3	-1.82					
Japan	-4.67	-3.05	-2.21	-1.51					
Korea	-2.84	-2.34	-1.96	-1.98					
Malaysia	-2.88	-2.58	-3.15	-2.72					
Mexico	-3.19	-3.24	-3.07	-4.46					
New Zealand	-2.21	-2.5	-2.7	-2.08					
Philippines	-3.12	-2.48	-1.81	-1.4					
Singapore	-3.54	-4.59	-4.33	-3.33					
Thailand	-2.08	-2.25	-2.1	-2.18					
US	-2.54	-2.27	-1.57	-1.61					

Semi-multivariate ECM precedence test

The calculation results on testing equations **エラー! スタイルが定義されていません。** .58 ~**エラー! スタイルが定義されていません。** .62 are given in Table 0-16 below. Column 1 shows the test statistic that EC(-1) (parameter c_1) in equation **エラー! スタイルが定義されていません。**.58 is zero, while column 2 presents the

χ^2 test for the hypothesis that $c_{31}=c_{32}=c_{33}=c_4=c_5=0$ also in equation エラー! スタイルが定義されていません。.58. In column 3 is the precedence test that all factors besides DLGDP(-1) precede LGDP ($c_1=c_{31}=c_{32}=c_{33}=c_4=c_5=0$). The same procedure is done in columns 4, 5 and 6 for equation エラー! スタイルが定義されていません。.60, and columns 7, 8 and 9 for equation エラー! スタイルが定義されていません。.62. Lastly, in column 10 the precedence test (where DLENROL is the dependent variable) result is given.

The interpretations are as follows. The independent variables can precede per-capita economic growth through two channels: first, through a joint effect with EC(-1) (note that this is the *speed of adjustment* parameter) and secondly on their own. The first channel is long-run in character while the second is short-run. Notice that we have constructed the tests in three parts, each part with three lags for one particular independent variable and one lag for the other two. Take the case for Australia, for example. Although its EC(-1) tests for LOPEN and LENROL are significant at 98 percent, it is not significant for LINV, with only 94 percent significance (of course it would be still significant at 90 percent, but for this illustration we impose 95 percent as the minimum acceptable significance). Therefore in the long run, change in enrollment and change in openness, jointly, plus short run effects of each variables play important roles in the country's long run economic growth. But lagged investment ratios do not jointly play the same role as openness or human capital accumulation.

Another way to interpret the results rests on the assertion that if the c_1's *and* all of c_3's, c_4's and c_5's are zero in equations エラー! スタイルが定義されていません。.58 ~エラー! スタイルが定義されていません。.62, then LINV, LOPEN and LENROL do not precede LGDP (results of tests of precedence are given in columns 3, 6 and 9). In the case of Australia, longer lags in investment ratios together with one lag each for openness and enrollment do not jointly precede economic growth. But, longer lags for openness with one lag each for investment ratios and enrollment *do* precede economic growth. This evidence can be shown to prove that the degree of economic openness and enrollment ratios affect economic growth, *in the long run. But the same case cannot be made for investment ratios.*

We now proceed to analyse the result for each country. It was hypothesised that more advanced countries' long term economic growth would not be affected by human capital accumulation in the sample period. In many instances the same case can probably be made for the degree of openness, but not so for investment ratios.

Australia. As discussed above, investment does not seem to affect growth the same way

as human capital accumulation or degree as openness. Although they all play significant roles in the short run, only openness and human capital affect growth in the long run, even if they all precede economic growth.

Canada. As we can reject the hypothesis that each EC(-1) term is significantly different from zero (even at 90 percent), all three independent variables are shown not to play significant long run roles. But in the short run investment ratios, degree of openness and enrollment ratios do precede economic growth. Statistically this could result from breaks in the series. Barring further information, the economic interpretation is that Canada's long run economic growth depends on factors other than investment, openness and enrollment.

Chile. This country presents one of the clearest examples where the three factors play an important role.

Table 0-16: Semi-multivariate precedence test

	Tests for LINV			Tests for LOPEN		
Dep. Variable	DLGDP	DLGDP	DLGDP	DLGDP	DLGDP	DLGDP
Indep. Variable	e(-1), DLGDP(-1), DLINV(-1), DLINV(-2), DLINV(-3), DLOPEN(-1), DLENROL(-1)	e(-1), DLGDP(-1), DLINV(-1), DLINV(-2), DLINV(-3), DLOPEN(-1), DLENROL(-1)	e(-1), DLGDP(-1), DLINV(-1), DLINV(-2), DLINV(-3), DLOPEN(-1), DLENROL(-1)	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLOPEN(-2), DLOPEN(-3), DLENROL(-1)	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLOPEN(-2), DLOPEN(-3), DLENROL(-1)	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLOPEN(-2), DLOPEN(-3), DLENROL(-1)
Hypothesis	$\hat{c}_1 = 0$	Parameters of DLGDP(-1), DLINV(-1)~DLINV(-3), DLOPEN(-1), DLENROL(-1) are zero	Parameters of e(-1), DLINV(-1)~DLINV(-3), DLOPEN(-1), DLENROL(-1) are zero	$\hat{c}_1 = 0$	Parameters of DLGDP(-1), DLINV(-1), DLOPEN(-1)~DLOPEN(-3), DLENROL(-1) are zero	Parameters of e(-1), DLINV(-1), DLOPEN(-1)~DLOPEN(-3), DLENROL(-1) are zero
Type of test	Student's t	χ^2 for joint significance	χ^2 for joint significance	Student's t	χ^2 for joint significance	χ^2 for joint significance
Columns	***1***	***2***	***3***	***4***	***5***	***6***
Australia	-2.14	59.33	603.72	-2.80	59.65	471.05
sig	*0.06*	*0.00*	*0.00*	*0.02*	*0.00*	*0.00*
Canada	1.38	34.24	70.43	-0.95	42.58	52.93
sig	*0.19*	*0.00*	*0.00*	*0.36*	*0.00*	*0.00*
Chile	-3.02	70.79	100.87	-3.45	131.55	97.90
sig	*0.01*	*0.00*	*0.00*	*0.01*	*0.00*	*0.00*
China	-0.10	24.45	125.01	-6.37	285.46	514.80
sig	*0.92*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Hong Kong	-1.36	14.82	23.20	-1.27	13.95	25.35
sig	*0.20*	*0.00*	*0.00*	*0.23*	*0.00*	*0.00*
Indonesia	-1.81	102.56	87.59	-2.28	119.63	106.15
sig	*0.10*	*0.00*	*0.00*	*0.04*	*0.00*	*0.00*
Japan	-0.08	46.15	78.27	-0.48	47.92	102.15
sig	*0.94*	*0.00*	*0.00*	*0.64*	*0.00*	*0.00*
Korea	1.78	25.85	172.38	1.88	20.47	199.79
sig	*0.10*	*0.00*	*0.00*	*0.09*	*0.00*	*0.00*
Malaysia	-1.26	19.89	27.40	0.21	9.78	12.85
sig	*0.23*	*0.00*	*0.00*	*0.84*	*0.00*	*0.00*
Mexico	-0.65	13.13	27.62	-0.43	12.58	18.35
sig	*0.53*	*0.00*	*0.00*	*0.67*	*0.00*	*0.00*
N. Zealand	-1.34	596.71	721.59	-0.94	328.33	397.08
sig	*0.21*	*0.00*	*0.00*	*0.37*	*0.00*	*0.00*
Philippines	-3.27	175.36	81.23	-1.53	99.43	42.30
sig	*0.01*	*0.00*	*0.00*	*0.15*	*0.00*	*0.00*
Singapore	0.73	186.61	250.88	-0.32	211.87	613.86
sig	*0.48*	*0.00*	*0.00*	*0.75*	*0.00*	*0.00*
Thailand	-0.16	105.49	199.75	0.39	108.33	146.96
sig	*0.87*	*0.00*	*0.00*	*0.71*	*0.00*	*0.00*
USA	0.06	49.21	307.33	-0.94	73.28	443.51
sig	*0.95*	*0.00*	*0.00*	*0.37*	*0.00*	*0.00*

Table 3.9: Semi-multivariate precedence test (continued)

	Tests for LENROL			Tests for LGDP	
Dep. Variable	DLGDP	DLGDP	DLGDP	DLENROL	DLENROL
Indep. Variable	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLENROL(-1), DLENROL(-2), DLENROL(-3)	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLENROL(-1), DLENROL(-2), DLENROL(-3)	e(-1), DLGDP(-1), DLINV(-1), DLOPEN(-1), DLENROL(-1), DLENROL(-2), DLENROL(-3)	e(-1), DLGDP(-1), DLGDP(-2), DLGDP(-3), DLINV(-1), DLOPEN(-1), DLENROL(-1)	e(-1), DLGDP(-1), DLGDP(-2), DLGDP(-3), DLINV(-1), DLOPEN(-1), DLENROL(-1)
Hypothesis	$\hat{c}_1 = 0$	Parameters of DLGDP(-1), DLINV(-1), DLOPEN(-1), DLENROL(-1)~DLENROL(-3) are zero	Parameters of e(-1), DLINV(-1), DLOPEN(-1), DLENROL(-1)~DLENROL(-3) are zero	$\hat{d}_1 = 0$	Parameters of e(-1), DLGDP(-1), DLGDP(-2), DLGDP(-3), DLINV(-1), DLOPEN(-1) are zero
Type of test	Student's t	χ^2 for joint significance	χ^2 for joint significance	Student's t	χ^2 for joint significance
Columns	***7***	***8***	***9***	***10***	***11***
Australia	-2.71	71.61	810.73	-0.16	300.86
sig	*0.02*	*0.00*	*0.00*	*0.04*	*0.00*
Canada	-0.69	38.08	47.35	0.16	46.26
sig	*0.51*	*0.00*	*0.00*	*0.21*	*0.00*
Chile	-2.88	139.38	77.00	0.07	38.27
sig	*0.02*	*0.00*	*0.00*	*0.66*	*0.00*
China	-0.79	81.89	256.69	0.14	14.03
sig	*0.44*	*0.00*	*0.00*	*0.56*	*0.00*
Hong Kong	-1.00	15.02	20.27	-0.17	86.53
sig	*0.34*	*0.00*	*0.00*	*0.20*	*0.00*
Indonesia	-1.27	96.53	52.33	-0.05	18.18
sig	*0.23*	*0.00*	*0.00*	*0.84*	*0.00*
Japan	-1.80	86.46	105.54	-0.05	47.92
sig	*0.10*	*0.00*	*0.00*	*0.64*	*0.00*
Korea	2.16	31.27	105.55	-0.09	242.90
sig	*0.06*	*0.00*	*0.00*	*0.24*	*0.00*
Malaysia	0.24	20.81	27.68	0.34	32.25
sig	*0.81*	*0.00*	*0.00*	*0.01*	*0.00*
Mexico	-0.56	9.73	20.86	0.30	13.87
sig	*0.59*	*0.00*	*0.00*	*0.14*	*0.00*
N. Zealand	-0.22	249.94	151.61	0.07	510.58
sig	*0.83*	*0.00*	*0.00*	*0.14*	*0.00*
Philippines	-1.38	104.15	38.69	0.04	193.95
sig	*0.20*	*0.00*	*0.00*	*0.56*	*0.00*
Singapore	-1.83	254.43	85.23	0.23	157.97
sig	*0.09*	*0.00*	*0.00*	*0.00*	*0.00*
Thailand	-1.93	165.27	271.01	0.10	79.22
sig	*0.08*	*0.00*	*0.00*	*0.33*	*0.00*
USA	-0.78	73.67	498.23	-0.09	695.16
sig	*0.45*	*0.00*	*0.00*	*0.04*	*0.00*

China. Only degree of openness seems to play any role in this country's long run economic growth. The introduction of three lags for investment ratios or human capital accumulation cancels the effects of investment, openness and enrollment in the long run.

Hong Kong. For Hong Kong we can reject the hypothesis that investment ratios, openness and human capital accumulation played any role in long term economic growth. Therefore, if the data is to be believed, there are other factors at play. In the case of openness, it is easily explained by the fact that Hong Kong is an economy where significant amounts of trade is re-export. Therefore degree of openness becomes rather irrelevant as a causal factor for economic growth.

Indonesia. Investment and openness seem to play significant roles in Indonesia's long term economic growth. Human capital accumulation does not make such a difference.

Japan. Not surprisingly for Japan, the evidence shows that investment and openness do not play significant roles in long term economic growth for the sample period of 1970~1992. In terms of human capital the test statistic is marginally rejected. Therefore even though Japan already had very high rates of enrollment by the late 60s, its increase still impacted economic growth well into the early 90s. It is debatable whether high investment ratios or any degree of openness contributed to Japan's long term economic growth since the 70s, with the possible exception in public investment and private investment, especially in energy saving technology.

Korea. The case of Korea shows that investment, openness and human capital accumulation played significant roles in the country's long term economic growth.

Malaysia. Surprisingly for a newly industrialised country Malaysia's long term economic growth did seem to depend on investment ratios in GDP, degree of economic openness or human capital accumulation.

Mexico. For Mexico as well we cannot reject the hypothesis that investment, openness and enrollment did not play significant roles in long term economic growth.

New Zealand. Not surprisingly for a developed country, the evidence shows that all three factors, investment, openness and human capital accumulation did not seem to affect growth in the long run.

Philippines. Tests for the Philippines have mixed results. In the cases of investment and openness the evidence shows that both affect long term economic growth. Yet for human capital the test statistic is only marginally below the rejection range. It might be the case that human capital has only recently been given emphasis in the development effort.

Singapore. In contrast to the Philippines and Indonesia, Singapore's evidence shows that human capital is the only significant factor in the country's long term growth. The

same argument cannot be made for investment and openness. As it is for Hong Kong, a significant amount of trade in Singapore is re-export. Therefore the insignificance of the degree of openness as a cause of economic growth is easily understood. Less understandable is the case of investment ratios. One could speculate that for geographically small countries like Singapore and Hong Kong, investment especially in infrastructure plays somewhat less significant role (in terms of GDP) in comparison with larger countries like Indonesia or Chile. It is natural, however, to expect the importance of human capital accumulation in a service-based economy like Singapore's.

Thailand. The same situation as Singapore is evident in Thailand. Only human capital seems to play any significant role in long term economic growth.

US. As expected all three factors, investment, openness and human capital accumulation, do not affect long term economic growth in a mature economy like the tha of USA.

Focusing on the effect of human capital accumulation on long term economic growth, countries with such a feature are: Australia; Chile; Japan (even in 1970~1992); Korea; Singapore and Thailand. For the impact of openness the affected countries are: Australia; Chile; China; Indonesia and Korea. Lastly, for the effect of investment ratios in GDP to long term economic growth, the countries showing this feature are: Australia; Chile; Indonesia; Korea and Philippines. The countries with all three variables showing significant influence on long term economic growth are: Chile and Korea. In all countries it is shown that investment ratios, degree of economic openness and human capital accumulation precedes economic growth, yet the channels are different. That all three factors affect economic growth is easy to understand from the statistical point of view, as all three have been shown to be cointegrated with GDP growth, either as pairs or as a group. And economic growth, investment ratios and degree of openness are shown to precede enrollment ratios. In further research, when longer data series are available proper lag lengths should be tested to ascertain the chain of causality especially with regard to the relations between human capital and economic growth.

These results should, of course, be taken with a grain of salt and considered preliminary. There are four problem areas that can dilute the conclusions. *First* is the sample period. The sample period in this study, 1970~1992, was chosen for the convenience of comparison and data consistency. As countries in the sample were in different stages of development with regard to each of the independent variables or a combination of two or three of them, it is possible that the comparison could be irrelevant. Using earlier statistics, however, might be problematic not only concerning data quality, but for the argument that development process may not have started for

the least developed countries, therefore annulling any argument of the effects of human resource development, investment and openness effects on economic growth. Moreover, using higher frequency data cannot be done for such indicators as enrollment ratios.

Second is the problem with human capital indicator. Gross secondary enrollment was used because it was the most conveniently available at the time of this study. When a complete series on tertiary enrollment ratios becomes available it should be possible to replicate this study using what Romer would term a closer approximate for human capital (as it relates to technical change).

Third is the problem with breaks in series. When breaks occur they distort stationarity results. The main cause of breaks are regime changes, usually in the form of policies that affect the economic structure and changes in definitions. Those conducting further studies need to take into account of this phenomenon by gathering information on economic policies in the countries under study and by employing the Perron Additive Outlier test.

Fourth, the last problem, has to do with non-linearity in integratedness relationships. The stationarity tests employed in this study assume that the relevant variables are linear combinations of each other. They might not be. But econometricians have yet to devise a way to test non-linear stationary relationships.

Comparison with similar studies

A compilation of studies investigating human resource development impact on economic growth has been done by Behrman [Behrman, 1990]. He showed that in the case of South Korea, most studies that attempt to explain economic growth on account of human resource development are rather dubious both in the way the relationship is established and, even worse, in terms of the results. In the case of Thailand a few studies interestingly show that human resource development, especially education efforts could be conceived as following economic growth, not the other way around. In short association between human capital accumulation and economic growth can be shown to exist but there is not enough evidence for causality yet.

Skill Transfer, National Concerns and Regional Priorities

The appropriate frameworks of skill transfer, within a country or across countries, depend on the methods best suited to carry it out. This, in turn, rests on our perception of the transmission of knowledge. On one extreme, knowledge is thought to be completely transportable, which means that skills as one particular form of knowledge can be transmitted through large scale participation outside the particular work setting in which it is to be applied. The opposite extreme maintains that skills can only be transferred in the work setting, or in on-the-job training. The distinction is important not just for the formulation of national human resource development policies, but also for international technical co-operation.

From the national perspective, governments in their resource allocating role need to look more closely at which approaches work and which do not. It is high time to do so considering the recent disappointments with prevailing policies of providing large budgets for public vocational training centers. Additionally, many governments face fiscal pressures to spend less but more efficiently and this mood is now felt even in the educational sector, long a sacred cow. Furthermore fiscal pressures are not exclusive to developing countries, but are also facing the developed countries which are the sources of development assistance. Therefore a framework for re-prioritising technical co-operation in the area of human resource development especially training is needed.

For the purposes of reform an elucidation of skill transfer is germane as it is commonly taken for granted and very often a consensus view is mistakenly assumed. One example is the gap between Japanese technical co-operation with the actual practice of skill acquisition in Japan. On one hand Japan, along with other OECD members, provides funding for the establishment of training centers in developing countries as well as providing experts to either run these centers or provide advice on how to do so. Local instructors and administrators are sent to Japan and other advanced countries for training on skill transfer. On the other hand in Japan skills are more often transmitted through on-the-job instruction.

With regards to consensus most Asian countries until recently did not pay enough attention to the practice of skill transfer, mainly due to abundant labour supply, the dominance of the agricultural sector which absorbs a lot of workers, high labour turnover rates and labour-intensive production methods [Hongladarom, 1989]. What,

then, are the fundamental propositions regarding skill transfer? The next section provides some guidelines.

Skill Transfer Fundamentals

On a basic level, transfer of skills rests on the presumptions that it is possible to be translated or encoded into a packet, then transmitted by a means of communication (usually language), and lastly be decoded into a usable form. For most of modern history this has been the overriding epistemology. Yet as attested by the practice of on-the-job training this reductionist view may not be the only and perhaps may not be the best method of imparting skills.

Polanyi questions the reigning objectivist epistemology by proposing that all knowledge has a *sine qua non* personal element which consists of two parts.[9] The first is called the *passionate commitment to acquired truth* which is upheld and validated in a "scientific community."[10] This is easily understood in the citing authorities in any particular field of inquiry to support an argument. Second is what could be called the *Gestalt*, where tacit particulars are integrated into a whole as exemplified in the process by which physicians perform diagnoses.

For example, many studies have shown that workers in chemical plants posses very high skills in calibrating complex machinery for the purposes chemical mixing, without having advanced degrees in chemistry. The same phenomenon is also witnessed in airline pilots who are very skilled in handling aircraft controls without detailed knowledge of aerodynamics or the molecular mechanics of metal fatigue. In these and many other instances skills are seen as transferred or acquired in long periods of on-the-job training.

Koike [Koike, 1990] who sampled Japanese as well as Malaysian and Thai indigenous firms, identified on-the-job training as the most effective method of skill transfer for the majority of skills but more importantly states that "... a large part of the skills and knowledge in the workplace are of a type that can probably be transmitted only through on-the-job training."

This point relates directly to the concept of options value as discussed in chapter two. For example, if the precise nature of calibrations for a particular machine is difficult to formulate and transmit, the ramification is that the decision making process in a firm is

[9] *Tacit Knowledge*, by Karl E. Sveiby, downloaded from www2.eis.net.au/~karlerik/Polanyi.html.

[10] The existence of a national system (whatever the form) whereby skills acquired in on firm can be certified and therefore easily transferred to other firms, parallels the first part of Polanyi assertion on personal knowledge.

fraught with uncertainties, particularly with regard to the future. This forms the cornerstone of Frank Knight's analysis of labourers, including unskilled labourers, who face uncertainty, particularly with regard to changing circumstances in the work environment. To increase efficiency, this uncertainty needs to be decreased or eliminated, and one way to do so would be to remove non-routine decisions from operators and require supervisors to deal with them. Supervisors, in this scheme, are believed to be able to cope with foreseeable uncertainties, but in picking supervisors who it is assumed have the ability to know if they can handle these uncertainties, something that poses still another uncertainty. If it is possible to pick supervisors with this skill with certainty, most uncertainties in the shop floor will be removed. Yet options value is one component which underscores the informational constraints faced by firms in knowing the values of new recruits, the very fact of which might make firms want to invest in general training.

On-the-job training is most often associated with specific skill development and off-the-job training, with general skill development. This view develops from observations that skills that are particularly difficult to impart through manuals or taught outside the work setting are best transferred using on-the-job training. The usual method consists of junior workers observing more senior workers performing a particular task. Afterwards junior workers are required to perform similar tasks, usually at less complicated stages, moving, in time, to more complex ones, all under supervision. Then the junior workers are left on their own to do less complex tasks. Eventually the junior workers accumulate enough skill to be entrusted with more complex tasks. This is particularly true at the operator level and to a lesser extent, at the supervisor level. Off-the-job training is carried out only occasionally for the purposes of comparing notes, or introducing new techniques or new technologies.

In this common scheme it plausible that general, as well as specific skills, are absorbed. Even if the tasks assigned to junior workers are specific to the firm, it is inevitable that the workers absorb some general skills, at least those associated with how to handle unexpected situations, along with general management abilities. These kinds of general skills cannot be denied to the worker. Firms often find that increases in general skills of their workers alone, without commensurate increase in specific skills, can help increase productivity.

For managers, however, off-the-job training is the preferred method of skill acquisition, giving the appearance that what managers accumulate are general skills. Of course this might not be the case at all. High white collar turnover rates in countries with shortfalls in managerial workforces can be taken as evidence that off-the-job training imparts mainly general skill, at least for workers at the managerial level. The pertinent

question to ask here: is there evidence to support the assertion that firms do engage in general training? The next section gives a few examples.

General vs. Specific Training

Due to the difficulties in finding appropriate samples there are few studies which explicitly embark to find out if firms actually engage in general training, although there are many that draw implicit conclusions. Three of the most relevant are presented below, using UK, US and German data.

Green [Green, 1996 #3], using UK data for a particular 1970 cohort (those born between April 5th and 11th) sampled in 1992 shows that short training programs (two days or less) do not affect wages, but longer training spells have a positive impact. Furthermore it was shown that there were no significant wage differences from acquiring general versus specific-skill training. This supports the Katz and Ziderman assertion that asymmetric information blurs the distinction between specific and general training.

Differentiating specific from general training implicitly comes with the assumption that the next firm has completely different skill requirements from the first. An important study, [Neal, 1995], however, provides evidence to the contrary. The data used is The Displaced Worker Survey from the monthly US Current Population Survey supplements for 1984, 1986, 1988 and 1990. Individuals in the surveys were queried for displacements up to five years before the survey date. Importantly, the sample is from the subset of workers who lost their jobs due to closings of establishments and not from firings. Skills are differentiated into general, industry specific and firm specific. It was found that workers who found post-displacement jobs in the same industry earn significantly higher wages vis-à-vis those who did not. This proves that the workers who stay in the same industry receive compensation for some form of industry-specific skills. Tenure in pre-displacement firms was also shown to be compensated for. An important qualification in these findings is that it is currently not possible to unambiguously argue that the set of industry-specific skills is actually different from the set of occupational-specific skills. Albeit, the evidence does point to the fact that even if occupational, instead of industry specific skills, are dominant, this set of skills is worth more to employers in the same industry vis-à-vis employers in other industries.

Another important study which seeks to elucidate the extent of firm specific training was provided by Werwatz [Werwatz, 1996] on apprenticeship training in Germany. The question posed was: why would firms voluntarily provide training for apprentices in the face of positive net costs, when these apprentices can easily transfer to other

firms (the national apprenticeship system provides for a nationally accepted certification)? One possible answer is that firms do engage in apprenticeship training because it provides firm specific skills. However, one of the main findings shows that apprentices who leave firms providing training actually had increases in wages. This suggests that apprenticeship training is not as firm specific as first thought. Nevertheless, some firm specific skills are certainly absorbed by apprentices and the lengths of their stay in firms providing training seem to be cost justifiable.

The availability of a nationally recognised skill certification system enables workers (or apprentices, whichever the case may be) to move from one firm to another with a minimum of loss in benefit. This system, therefore, encourages turnover, but discourages firms from engaging in general training beyond what is required under the apprenticeship system for apprentices or beyond the absolute minimum required for regular workers. The advantage of the system is to enable young workers to find suitable careers (in terms of job types and firms) by minimising switching costs. In general, this will result in a highly motivated workforce and better worker-firm matching, ultimately increasing productivity.

Another advantage of the German apprenticeship system lies in its effect on expectations. The system, the modern equivalent of the culmination of a long historical development, responsible for creating an atmosphere where high school graduates who are unable to continue to college are kept from being discouraged, a recurrent theme behind the ineffectuality of vocational training schemes in many countries. The German "dual system" as applied in Thailand will be discussed further below (also see appendix B).

Cross Country Comparison Of Skill Transfer

It is a well known fact that workers in developed countries are more productive than their counterparts in developing countries. The study by Koike [Koike, 1990] confirms this, but goes further to ask what role, if any, that skill transfer plays to account for it. An important feature of this study is it compares several firms in Japan with similar *indigenous* ones in Thailand and Malaysia. The inclusion of *indigenous* firms in Malaysia and Thailand served to ensure that local skill transfer methods were those that evolved *not* along the Japanese style. The industries studied were cement, car battery, machine tools and banking. Interestingly in cement manufacturing the technology employed in Thailand and Malaysia was slightly more advanced than that of Japan. Yet it was found that Japanese labour productivity in cement

industries are about three times that of the other two countries, and in car battery manufacturing it was more at around four times as high.

The authors were very careful to dispel myths associated with a cursory comparison of Japanese working practices versus those of other Asian countries. These included the illusions that lifetime employment, the seniority determined wage scale, on-the-job training, worker participation, which are the major determinants of worker productivity in Japan. The fact is, that these features factored little into productivity in other Asian countries, skill transfer was the deciding factor. In terms of skill transfer methods, there were major similarities among the countries studied, namely in on-the-job training. This is due to the nature of skill itself: transfer cannot be conducted through written or verbal instruction, but through demonstration.

Furthermore, the common belief that Japanese workers have a wider experience base than their counterparts in Asian developing countries was shown to be a fallacy. It is depth of experience that makes the difference. Depth of experience means the extent to which workers are experienced in facing uncertainties and unusual situations. Firms whose workers predominantly have deeper career spans are usually those with promotion systems where group leaders are promoted from production worker status, foremen from group leader status and supervisors from foreman positions. Such is the prevailing system in Japan. The basis for such a system is threefold: firm longevity, a stable history and a developed school system. Firm longevity is needed because skill formation is a long term process. Stability is required as the system for skill formation and absorption need time to become established; shocks like introduction of new management or technologies will take time to be gestated at shop-floor level. A developed school system is necessary as skill absorption requires a minimum working knowledge on the part of workers and requires workers to study by themselves. It cannot be overemphasised that the educational system cannot impart particular skills, that that is the job of vocational and firm training. In terms of education, what are the special requirements that developing countries' educational systems need to cater to, in the face of recent economic trends? This will discussed next.

Educational Priorities In Developing Countries: A Brief Overview

The consensus view regarding unemployment in developing countries is that it is structural in the sense that most enterprises have increased the average skill requirement level of their workers, particularly through hiring better skilled recruits,

even in the face of lower wages for relatively unskilled workers. Although to a lesser extent, in some cases, demand deficiency remains a problem. Also, structural reasons, to a lesser extent can now be said to account for some of the unemployment in more developed APEC member economies.

In Table 0-3 estimates are given on excess labour supply for APEC members. These estimates are very crude in that no sectoral breakdown is given. There are certainly sectors with an excess supply of labour and those that face very tight labour supply constraints. The former are usually the agricultural and small scale, often informal, services sectors, while the latter (most often characterised as "modern" sectors) are mainly manufacturing and modern services. Although countries like Malaysia, Thailand and Singapore are facing very tight labour market situations, it is certain that in its modern sectors it is even tighter than the average. This calls for a flexible labour force, which in turn relies on inculcating skill like communications and negotiations, logical thinking and ability to get along with co-workers, all of which are considered general skills. It goes without saying that this aim should be put on top of the more basic policy of illiteracy banishment. Furthermore, technological capabilities need to be developed.

These suggestions certainly do not make for a complete policy package. In sum what can be said about educational planning in developing countries is: planners need to start from the vision that each of their countries is facing a global development challenge; they should always bear in mind the adaptability of both the educational system and its products, a flexible and productive workforce. The role of public training in this effort and problems it is facing will be discussed next.

Training: Which Way Now?

It is common knowledge that vocational training, especially in developing countries, seldom delivers what is required by its supposed customers, the private sector. What is more puzzling, however, is the persistence of this problem [de Moura Castro, 1990]. The main reason has to do with the incentive structure. On one hand, quality improvement, which almost always requires disciplinary action or academic reform, and sometimes both, results in penalties for those on the receiving end-usually bad teachers, underperforming students and muddled administrators. Such punishments are tangible and visible (in many cases those punished also suffer from social stigma). Usually those likely to be punished rally to avoid getting punished or being blamed in the first place. Parents and teacher unions are usually the vehicle to such ends. On the

other hand, quality improvement is ethereal, and its advantages are diffused to all actors involved in the training process, therefore much harder for any one party to lay claim to.

Contrast the situation found in most developing countries' vocational school with cram schools, say, in Indonesia or Brazil. In Indonesia each year 400 to 500 thousand high school graduates sit in a nation-wide entrance exam to enter state universities with the combined capacity of about 65 thousand. Of course, competition is most intense for the more prestigious departments at the better universities. To answer this need, many cram schools have opened, mainly in the large cities to provide high school students with tutorials based on past exams. Larger cram schools publish the names of students who pass the exam just after official results come out. This provides for an incentive for the cram school system to perform well.

The most important avenue to create a better link between the performance of training institutions and the demands placed on them by the marketplace is to instil some measure of control from the ultimate customer of training institutions, the employers. The ideal arrangement would be for entrepreneurs to become board members of training institutions. Employers in this board should be the majority group with veto power, budget authority and the mandate to alter rules where and when necessary, instead of being the more usual token presence. The best examples of training institutions run be employers are those operated by chambers of commerce and other trade associations. Sweden provides an important example, where the best performing boards operate in single training institutions and for particular courses.

Decentralisation of training decision making is not without its problems, one of which is the creation of too many small administrations, each one of which needs a certain minimum size and budget to operate efficiently. This might lead to a more cumbersome and expensive arrangement, rather than having several medium sized agencies. The sizes of agencies will certainly vary from country to country, depending on among other things, the availability of good administrators.

Another avenue often suggested, that of providing training in enterprises is also not free from defects, one of which is for firms not to engage in actual training but to treat trainees as cheap labour. To avoid this particular problem, regular contacts between trainees and training institutions need to be maintained. Furthermore, the desire by governments to shift some cost burden onto the private sector should open the field for more enterprise training. One way to do this on a large scale is by the adoption of the so-called "dual system", which is the main vocational training system in Germany (see appendix B).

There have been some attempts to replicate the German "dual system". It has met with

some success, especially in Thailand but more often the system fails, due to the difficulty in creating an efficient administration and some reluctance on the part of employers to hire unskilled trainees who, most often, cannot work full time. In Thailand the "dual system" (called DVT) has been gaining a lot of attention and support. In terms of length of training the "dual system" and its alternative, the school mode, both give training for three years.

Employment counselling is one particular area in which training institutions are not known to be performing well. The problem stems from lack of current labour market knowledge on the part of administrators and instructors. Feedback from training graduates would certainly help alleviate the problem, but it would be more beneficial to seek out information regarding wages, employment opportunities and the qualification requirements of enterprises, all of which need not cost a lot if training institutions kept good contacts with the private sector.

The traditional means of promoting enterprise training by fiscal means (usually in the form of levies) alone does not seem to be working well. Some enterprises consider this as an additional tax, rather than investment, which defeats the purpose of the system. One way out would be to bring firms into the decision making process regarding training. The system needs to be flexible enough to meet new challenges in the domestic economy as well as changing global competitive conditions.

Another system, which revolves around tax rebates given to firms which conduct training, is scarcely utilised, mainly because most firms find the process long and arduous. On top of cumbersome administration, in many cases, firms and governments cannot agree on the type of training, length of training and the percentage of employees that need to be trained as the bases for eligibility. What is more important is a framework where employers are involved in designing the national training agenda.

Effectiveness Of Public and Enterprise Training: Hong Kong, Indonesia and Japan

In this section selected issues of vocational and company training efficacy will be highlighted. The aim is not to list every country's labour market development or a complete picture of its human resource dimension. Instead selected issues, especially the current state of each country's technical and vocational education system and the perception of enterprise training, are discussed. Most of the material was gathered from APO [APO, 1993] and UNESCO [UNESCO, 1995].

Hong Kong

In general, the quality of technical and vocational education was found to be satisfactory. Glaring exceptions were in language standards, both English and Chinese, and the sense that students lacked originality and imagination. The latter could be explained by the so-called "spoon-feeding" approach in the primary and secondary level, which carries over to the tertiary level. By the time students reach tertiary education level they are already used to a system where "teacher knows best."

An evaluation of company training (in 1991) found that productivity improvement, morale, expansion of skills and increased ability to cope with new technology were among the most important motivations for human resource development activities. Non-managerial professionals, managerial staff members and technical workers were the top three groups whose involvement in HRD activities was felt important. For on-the-job training, self-learning and observing seniors at work were the most important modes. Interestingly budget size was not considered important.

As expected, managerial staff members were given higher priority for off-the-job training. It was found that feedback from a substantial number of employees who undertook both off-the-job and on-the-job training were not utilised in future planning decision making. This is certainly a major disadvantage affecting the flexibility of training.

In terms of effectiveness, 30 percent of workers in the sample described on-the-job-training as being not especially helpful, and around 50 percent replied that off-the-job-training had had questionable impact. Integration of training with the rest of human resource management activities (recruitment, promotion, technological innovation, etc.) appeared weak. Lastly, as in the case of several other countries, notably Indonesia, Singapore and Malaysia, external hiring was the preferred method of raising the general skill level.

Indonesia

Most observers agreed that public training centers were not operating effectively and recent budgetary constraints were not helping. But even when budget was not a problem they were not performing well. The main efficiency issues revolve around the cumbersome budget disbursement. For example, most public training centers have been empty 6 months a year (usually between June and December), as operating funds have not been properly disbursed from the treasury. Furthermore, a substantial portion of the budget has been allocated for routine expenditures, such as administration and evaluation, and not on course implementation. Important materials such as textbooks, manuals and "consumables" (such as fuel, chemicals, wood and others) have been

either available in substandard quality or not at all. An additional problem is that there simply have been too many courses offered and not enough focus.

Although tax credits are given for training, until recently the information was not disseminated widely enough that many firms, especially small and medium scale enterprises were not aware of its existence. Furthermore, tediousness in getting the refunds resulted in a very low utilisation level. In 1993 the new cabinet launched the so-called "link and match" system, in which private-public co-operation in designing vocational education curricula would be strengthened. So far this has not been given much attention by the private sector, which regards it as nothing more than political rhetoric. Tacitly, it is accepted that Indonesia's comparative advantage rests on cheap labour.

On the other hand, from observation of eagerness to participate, internal human resource development, especially on-the-job training seems to have been quite effective in raising worker skills. On-the-job training has also gained momentum from the current awareness of worker participation and quality control (especially since it has become necessary to acquire ISO standard ratings to export, and acquiring ISO standards help firms' stock values). Yet outside the more established firms in the manufacturing sector (with Astra, the vehicle assembler as the standard bearer) it was difficult to find systematic on-the-job training schemes. When asked, most firms would reply that new recruits who are on a probationary status for 3-6 months are given on-the-job training by more senior workers.

In general, human resource management policies were not well articulated in firms. Workers, as a consequence, did not express opinions or offer suggestions as they were not invited into the decision making process.

Japan

There is a prevalent belief that upper secondary school students with good grades will continue to university education while the rest will go on to vocational schools. This is among the reasons for the lack of self motivation of vocational students and the consequent high dropout rates in vocational schools. Additionally there is the view, especially by larger firms, that specific skill can be accumulated in-house so that generally educated recruits (meaning university graduates) are valued more highly. Graduates of vocational schools are preferred by small and medium scale enterprises without in-house training capacity and increasingly by agencies providing temporary workers.

The general opinion from the survey was that educational qualifications, although valued more highly than skills, were not sufficient and needed to be supplemented by

working experience. Although on-the-job training is more widely conducted in larger enterprises, in smaller firms there is a tendency for more variety training, due to fluctuating production levels. As to the method of on-the-job training, among non-managerial workers it is conducted mainly by coaching, while for managerial staff the prevalent mode is learning by watching seniors. Enthusiastic instructors, eager-to-learn employees and overall company support were the most important determinants of successful on-the-job training. Again budget was not considered important.

Off-the-job training activities are mainly targeted towards clerical rather than professional or technical staff, and it is also more general in nature. For specific firm skills, it was found that the as the higher one moves up in the firm the ratio of off-the-job to on-the-job training falls. This paradox is the result of the preponderance of large firms in the sample. Large firms tend to have their own training centers or at least can spare the facilities for in-house training sessions. These activities, although technically off-the-job, might be firm specific in every respect.

Larger firms were found to conduct more off-the-job activities vis-à-vis smaller ones, and for general types of training, less is being done in-house with larger proportions being out-sourced. The importance of (overall) human resource development is felt highest among new employees, non-managerial professional, managerial staff and top management (in that order). However, satisfaction with human resource development activities is, surprisingly, rather low. The most unsatisfied were top management, managerial, non-managerial professional and part time employees (in that order). One reason is that expectations are to high on the impact of human resources development activities on productivity.

Skill Transfer Across Countries And Technical Co-operation

As more companies relocate some or all of their production capacities from the more developed Asian countries to the less developed economies to reap locational advantages, cross country skills transfer becomes an increasingly important consideration. Other than the attention on Japanese investment in developing countries and its corresponding human resource challenges, investment flows from more developed Asian economies have not been going on for a sufficient length of time for its corresponding human resources development issues to acquire enough attention.

The prevailing view is that transplantation of the Japanese skill transfer system is difficult, given its reliance on the unique Japanese culture of group orientation. However, as the study by Koike *et al.*, cited above shows, there is nothing peculiar

about the system which relies on on-the-job training and long-term career planning. The same system is shown to operate both in Malaysia and Thailand, in the manufacturing and the services sectors.

Therein lies the inconsistency of technical co-operation in human resource development. Whereas on-the-job training is the prevalent method of imparting skill in the workplace among recipient countries, almost exclusively in Japan and other developed nations, it is paid little attention in technical co-operation. This is not to say that off-the-job training is not useful. But relying on off-the-job training misses a very important method by which skill can be imparted. An example of the exception to the almost exclusive dependence on off-the-job training as an avenue of technical co-operation is the acceptance of trainees in Japan by JICA (Japan International Co-operation Agency) and AOTS (Association for Overseas Technical Scholarship). JICA mainly caters to training of public officials while the AOTS focuses on the private sector. AOTS receives about 25 percent of its funding from the private sector, which is heavily involved in its decision making process. The activities of AOTS will be discussed further in chapter 5.

The Three Efficiencies

Any discussion of national or international skill transfer mechanisms should not leave aside the three insights into efficiency, namely Smithian, Keynesian and Schumpeterian. Smithian efficiency is concerned with allocation of resources and the use of price to ensure correct amounts of the right commodities are produced at the appropriate costs. Macroeconomic potential (or full employment) output that is lost in a recession is addressed by Keynesian efficiency. Schumpeterian efficiency, on the other hand, addresses the long term effects of technology on economic growth. Besides the long time horizon, Schumpeterian efficiency is also based on the condition that resources can be spared for technological advancement.

In terms of Smithian efficiency, governments should, by using the correct incentive mechanisms, increase performance of public and private training activities. But this should occur without sacrificing both the Keynesian or Schumpeterian efficiencies. For example, policies that seek to increase efficiency of public training facilities might end up putting trainers out of work and decreasing capacity. An example of the ruinous effect of competition in the race for Smithian efficiency can be seen in the underinvestment of proper curricula in MBA education flooding South East Asian countries. On the other hand, policies that focus only on the employment aspect

of training programs can use up resources that might, if properly channelled, improve training content to better suit long term growth requirements.

Technical Co-operation, with special reference to Japanese intake of trainees

In the previous chapter the discussion of on-the-job training indicated that it is probably the best way to transfer skills, especially in the manufacturing sector. What of its application to international technical co-operation schemes? This chapter provides an tentative answer using the case of Japanese technical co-operation as example.

Taxonomy of Japanese technical co-operation

Technical co-operation as part of economic co-operation can take many forms, but the basic premise remains that it hinges on transfer of expertise embedded in human beings. This is illustrated, for the case of Japan (table 5-1), where technical assistance is focused on human resource development. Aside from awarding scholarships to overseas students, the main activities are acceptance of trainees and dispatching experts and trainers.

Table 0-1: Scheme Of Japanese Economic And Technical Cooperation

Category	**Sub-Category**	**Activity**	**Executing Agency**
ODA	Financial Assistance	Loans, grants, contribution to multilateral bodies	Mainly OECF
	Technical Assistance	Acceptance Of Students	Ministry of Education
		Acceptance Of Trainees	JICA, AOTS
		Dispatch Of Experts	JICA, JODC
		Dispatch Of Volunteers	JICA
		Supply Of Equipment	JICA
		R&D	JICA
		Survey & Consultation	JICA
Other Official Flows	Export Credit		EXIM Bank Of Japan
	Direct Investment		OECF
Private Flows	Technical Assistance		
	Private Financial Assistance		Guarantor Private Banks And EXIM Bank Of Japan

Source: [AOTS, 1996]

On the inflow side, there are two predominant institutions: Japan International

Co-operation Agency (JICA) and Association for Overseas Technical Scholarship (AOTS). As stated earlier, JICA mainly caters to training in the public sector in such areas as medical care, forestry and agriculture while AOTS focuses on the private sector. For the purposes of illustrating skill acquisition, the private sector provides a better example as it is here that one would find cases of how workers get acquainted with Japanese training style. AOTS serves as a good case for several reasons: first it provides training for private enterprise workers; secondly, the main portion of training is conducted on-the-job in Japanese private firms; thirdly, its board includes representatives from the private sector; fourthly, its management is independent and lastly, it has built a strong alumni society.

The AOTS was started in 1959 by a group of pan-Asianists who felt that Japan should repay Asian countries for its 2nd World War atrocities. One way to accomplish this goal would be to provide technical assistance in human resource development. This interest coincides with that of the Japanese Ministry of International Trade and Industry which was, at the time, busy promoting exports. It was thought that having trainees spend time in Japan, working alongside Japanese workers and using Japanese machinery might help dispel the myth that Japanese technology was inferior to its Western competitors'.

AOTS Developments

AOTS runs a variety of training courses structured around orientation programs and specialised training by host companies. Orientation programs run from one week to thirteen weeks. For specialised training AOTS plays the role of supervisor and advisor to ensure it is optimal from both the companies' and trainees' viewpoints.

Up to 1996 it has trained close to 70,000 individuals from over 150 countries. Outside Japan it has organised a multitude of training activities in which more than 59,000 individuals have participated. Recent years have seen a steady increase in its intake of trainees from overseas, although with the fiscal restraints facing the government of Japan, the annual intake might decelerate. The proportion of AOTS trainees either to the total number of trainees in Japan or in ODA related activities has remained the same for the last five years (table 5-3), something that can be construed to reflect its adaptability to the government budget cycles.

There is no bias in sectoral allocation of trainees. This is because the number of trainees in each sector/training type is the result of a deliberation process that balances *demand* for training manifested through requests, *supply* (in the form of training capacity of member enterprises) and *budget*. Recruitment decisions are made in periodic meetings between representatives of member firms and AOTS administrators. There are two special features of recruitment worth noting in their relationships to the trainees' career planning. These two features address, to a certain extent, the common problem of high turnover rates that enterprises face in training workers generally, and more specifically in sending them abroad.

Table 0-3: AOTS Training By Field In 1994

Field	Number of trainees
Auto, Transport Machinery	733
Electric, Electro, Communications	752
Machinery	532
Metal, Steel	203
Chemical, Petroleum	136
Textile	96
Food, Wood, Agriculture, Fishery	89
Ceramics, Mining	53
Construction	147
Management	1,481
Others	222
Total	4,444
Source: [AOTS, 1996]	

- ***Eligibility*** AOTS requires that nominating companies provide thorough background and "plan-of-use" for prospective trainees. Especially important is the "plan-of-use" information, where the companies should be able to show how returning trainees will function and how trainees can disseminate their acquired knowledge. Each company must guarantee that returning trainees will be posted back at least at their pre-training levels.
- ***Contract*** Companies should provide prospective trainees with work contracts after returning from training. These should not be too restrictive in the sense that they require returning trainees to work for periods which are too long. On the other hand they should also provide for periods long enough for the companies to recoup costs entailed in sending trainees.

AOTS is conducting more management vis-à-vis technical training due to increasing demand in recent years (table 0-3).

Relationships between host companies and trainees can be categorised broadly into two

types: commercial and non-commercial. Commercial relationships include joint ventures, customers of Japanese equipment exporters, overseas sales agents of Japanese firms, among other. Non-commercial relationships are defined for cases where applications are not based on any business interest. Instead, trainees are recruited based on recommendations by non-commercial entities such as universities, multilateral organisations, and government agencies. A large proportion of trainees applying through the non-commercial channel are those recommended by the AOTS Alumni Society (table5-4).

Table 0-5: Number Of Trainees In Japan

Categories	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Entry By Training Visas	29,489	37,566	43,649	43,627	39,795	36,612
ODA Trainees	11,602	11,953	12,444	13,063	13,773	N.A.
JICA Trainees	7,632	7,556	8,096	8,363	8,834	9,562
AOTS	2,907	3,226	3,364	3,623	3,850	N.A.
Other Organizatios	1,063	1,171	984	1,077	1,089	N.A.

Source: [AOTS, 1996]

Table 0-7: Relations Of AOTS Trainees To Host Company

	1991	1992	1993	1994	1995
Non-Commercial					
Univ. Recommendation	74	46	23	26	33
Public Organization	240	205	175	171	183
Aots Alumni Society	458	579	582	926	1,069
Overseas Organization	55	58	132	200	207
Overseas Government	244	261	283	310	262
Subtotal	1071	1149	1195	1633	1754
Commercial					
Joint Venture	896	1,003	1,216	1,392	1,576
Plant Export	18	16	13	-	-
Customer	284	318	265	240	268
Sales Agent	279	283	227	199	165
Techical Tie-Up	431	520	471	479	493
Subtotal	1908	2140	2192	2310	2502
Others	385	334	447	501	496
Total	3,364	3,623	3,834	4,444	4,752

Overseas Training

It is a well known fact that the cost of training in Japan is rising faster than the budget can provide for. In response there is an increasing reliance on overseas activities. In the case of AOTS, overseas training is conducted under the auspices of AOTS, in partnership with local host companies which contribute to the training costs. Overseas training has the advantages of having lower cost per trainee and a wider reach (as trainees do not need to travel to Japan and local language is used).

An example of this is Kubota training done in Indonesia. The Kubota Corporation provides the trainers (mainly from Japan) and shoulders 40 percent of costs. AOTS rules require a minimum of 50 percent of those involved be outside participants, and that the opportunity should be widely publicised. AOTS also insists that overseas training should inculcate future trainers in the local community. In most cases, repeat training activities have been conducted up to three or four times with decreasing reliance on Japanese experts. Afterwards such training activities are run by local trainers, although still under the auspices of the AOTS.

An additional benefit of overseas training is that it can be tailored to best suit local needs. An example is training in boiler calibration as part of an energy conservation campaign. In Japan, in contrast with most developing countries, most boilers are computer controlled, obviating the need for manual calibration. Therefore, training is more suitable to be conducted abroad, with instructors sent from Japan. This is an example of the class of training programs better conducted overseas (where training is conducted on technologies no longer used in Japan or altogether different kinds of technology are used). The trend towards greater reliance on overseas training can be seen in table 5-5.

A large helping hand in conducting AOTS overseas activities is provided by its Alumni

Table 0-9: Number of AOTS Trainees By Program Category

Types Of Program	1990	1991	1992	1993	1994	1995	1959-95 (Cumulative)
Regular	3,226	3,364	3,623	3,834	4,444	4,752	63,858
Overseas	1,087	2,068	2,698	2,788	3,601	3,328	20,449
JMF Sponsored	125	128	111	123	84	95	3,143
Trainer's Training	141	147	101	134	158	174	1,413
Total	4,579	5,707	6,533	6,879	8,287	8,349	88,863

Source: [AOTS, 1996]

Society. This "society" is represented in 58 chapters in 38 countries (as of November 1996). The activities of AOTS alumni society include holding seminars and get-togethers, providing Japanese language courses, recruitment for training in Japan (see table 0-7 for the growing importance of Alumni Society in terms of recruitment), pre-departure programs, assistance to overseas training courses, and inter-alumni exchange programs. The last activity is becoming more important, forming part of the South-South co-operation scheme.

There are, however, three advantages to training in Japan that would be difficult to be substituted by overseas training. *First* there are beneficial effects of on-the-job training that trainees in Japan enjoy which are unavailable to those participating in overseas training. *Secondly*, and more controversially, training outside one's own environment (especially outside one's own country) can provide the "necessary jolt" to one's consciousness. Take the case of an entrepreneur-owner of a small scale business. On a moment's notice, a particular scene might impregnate his mind with a few bright ideas which might never occur inside any classroom and in the familiar setting back home. *Thirdly*, there is a greater chance of learning from mistakes. When training is done overseas technologies and examples used are most probably Japanese success stories. Training in Japan, on the other hand, provides opportunities to learn from past mistakes even if this angle is not emphasised.

Survey of ex-trainee, an example

A survey was conducted in Sri Lanka in 1995 to assess the effects of training on past participants. The survey collected 85 questionnaires out of 150 former participants of PSRE (Program for Sri Lankan Entrepreneurs) [Yuki, 1996]. The following results were found:

- 95% reported a good to very good overall evaluation.
- Most participants prefered practical work as opposed to classroom lectures.
- Among skills acquired production management, quality management and human relations were found most useful; the least useful were Japanese management systems, Japanese-style labour relations and Japanese business strategies.

Problems And Prospects For Future Technical Co-operation

As discussed above, the main constraints to increasing technical co-operation in human resources development such as the AOTS programmes, are decreasing amounts of budget

allocations and the rising costs of training in Japan. Additionally the requirement of Japanese language courses prior to any training activity is, although unavoidable, seen as something of a burden. There are also problems facing overseas training. One is the increasing difficulty in finding willing and able participants who are interested in staying abroad, sometimes in remote regions, for significant amounts of time. Another problem is that foreign trainees sometimes perceive Japanese trainers as holding back "the key" or "the secret" to whatever technology or technique is being transferred. This view is not unique to foreigners. Japanese themselves in many cases describe how they acquire skills as "stealing" from their seniors. And of course, no discussion on training in Japan would be complete without discussing the "training not working" issue.

Many trainees from abroad complain that instead of explicitly getting trained they are simply told to work alongside Japanese workers. This phenomenon relates to the view discussed in the previous chapter in which skills cannot be easily transferred outside the shop floor. Even on the shop floor, skills can only be demonstrated and new workers need to duplicate and then practice them. But the real test comes when something unexpected happens. For this to take place workers must spend some time in the actual work place, and for that reason sufficient waiting time is most often required before something unexpected actually occurs.

In the future, demand for management training will certainly increase in such areas as quality assurance, productivity management, environmental protection and export marketing. Looking forward to the information age, it is not inconceivable that training in knowledge management and dissemination will in demand. These areas are so new that many governments, let alone technical co-operation agencies, have not caught up. Yet supply deficiencies are already felt in the private sector, which is indicated by the high pay that Internet page designers and technologically savvy workers are commanding.

With the fiscal problems facing the governments of Japan and other OECD countries, ODA will probably decrease in the future. It is therefore high time that the priorities of technical co-operation be sharpened. One area of high priority has always been human resource development, but it has not been spelled out decisively enough to provide clear guidance for future action. Even as total ODA decreases the proportion marked for human resource development activities in ODA should increase. For developed Asian countries like Korea, Taiwan and Singapore, with their newly acquired affluence, comes a certain responsibility long thought the exclusive domain of the US, Japan and

rich European countries, and that is playing their roles in contribution in technical co-operation to less developed Asian economies (among other regions). This is not the only reason. In its early stages, technical co-operation is usually focused on developing business opportunities (existing or foreseen in the near future). Therefore the increasing amounts of investments from developed Asian economies in less developed Asian economies is another basis for increase in technical co-operation.

Conclusions

Specific training is not the only kind provided by enterprises. For some time this empirical observation has been recognised, but it did not have a firm theoretical foundation until Katz and Ziderman proposed that under uncertainty, positive costs might have to incurred by recruiting firms to obtain information on the skills of potential new recruits. This reasoning effectively cuts the ground under the argument that inter-firm transfer of skilled worker is implausible.

Utilising an error-correction model an investigation was done on the causality between economic growth and a set of factors which are investment ratio in GDP, economic openness and human capital. For some countries human capital accumulation was shown to affect long run economic growth. For other countries, only when combined with openness and higher investment rates, does human capital affect long run growth. This suggests that accumulation of human capital is a necessary but insufficient condition for long term growth.

Combining evidences for general training and the case for on-the-job training leads to the conclusion that training is best conducted in the work setting and it is transferable. The implication for the first segment of the labour supply needing training (first-time job seekers) is: there is strong support for the German apprenticeship system. For the second segment (workers needing to upgrade their skills), there are two related implications, one for national training policy and another for technical co-operation in human resource development. For national training policy, more resources need to be poured into in-company training, or even inter-company training, to the extent that an optimal administrative, budget and content arrangement mix can be designed. For technical co-operation, more attention needs to given to the model that AOTS has developed.

There remain large gaps in our understanding of the optimal methods of skill inculcation and transfer. This paper purposefully skirted the issue of how the best skills are discovered in the first place, and only discusses how they can best be transferred. There is no doubt that a deep probe into how skills are arrived at will provide insights into how they can best be transmitted.

The impact of human capital on economic growth is a worthwhile inquiry but perhaps with a more microeconomic flavour, especially in the face of limited understanding of the actual content of skill. Perhaps the most interesting question is with the role of

language. I would like to close by quoting Wittgenstein: “Whereof one cannot speak, thereof one must be silent.”[11]

[11] Ludwig Wittgenstein (1889–1951), Austrian philosopher. *Tractatus Logico-Philosophicus*, sect. 7 (1921). Wittgenstein had elaborated in the book’s Preface: “What can be said at all can be said clearly, and what we cannot talk about we must pass over in silence.” Karl Popper, in his *Conjectures and Refutations* (1963), reported Franz Urbach’s rejoinder to this: “But it is only here that speaking becomes worthwhile.”

Appendices

Appendix A: Variance and Covariance of ECM equations

Table 0-1 provides variance and covariance estimates of the residuals of equations **エラー! スタイルが定義されていません。** .58 **~エラー! スタイルが定義されていません。**.62. For the purposes of comparison columns 1 and 2 show the variance and covariance of the OLS of LINV, LOPEN and LENROL on LGDP.

In columns 3 and 4 are the variance and covariance of the residual from equation **エラー! スタイルが定義されていません。**.58, columns 5 and 6 for equation **エラー! スタイルが定義されていません。**.60, and lastly columns 7 and 8 for equation **エラー! スタイルが定義されていません。**.62. All variance and covariance for the ECMs are zeroes (up to two decimal places). It is concluded that the residuals in equations **エラー! スタイルが定義されていません。**.58 **~エラー! スタイルが定義されていません。**.62 are white noise, and therefore confirm the Granger representation theorem.

Table 0-1: Variance and Covariance of error terms from ECM equations 3.29~3.31

	OLS		LINV		OPEN		ENROL	
	var	cov	var	cov	var	cov	var	cov
	1	2	3	4	5	6	7	8
Australia	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Canada	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Chile	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
China	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
HK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Japan	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Korea	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Mexico	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
N.Zealand	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Phillipines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Singapore	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Thailand	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00

Appendix B: The German "Dual System"

This is the much discussed vocational educational system used in Germany. It is called a dual system because it emphasises on-the-job working experience and classroom learning equally. About two thirds of Germans between the ages of 16-19 participate in this program, which amounts to about 1.6 million persons annually. Presently there are more than 400 types of training to choose from. Out of five working days, trainees usually spend one or two days in class sessions and the rest of time working in enterprises. The program takes three and one half years to complete. Afterwards, trainees acquire certification and are free to find jobs without any obligation to the government. The costs of running vocational educational centers are borne by state governments while the governing institution is funded from the federal budget. Levies on firms finance training boards and chambers in exchange for services rendered (such as counselling). Firms taking in trainees, in turn, pass on the costs associated with training to consumers, which is a form of an indirect taxation. The total cost is estimated to be about USD 27 billion per annum. On the other hand consumers are subsidised indirectly through the contribution of trainees to output and ultimately from their contributions to quality and productivity [UNESCO, 1996].

The system has very strong political support and has been among the proudest German cultural exports for some time. In the US, several states have adapted this system to a certain extent, but Wisconsin took it in lock, stock and barrel (The Economist, February 15th 1997). The results so far have been so encouraging that the Wisconsin state government plans to expand the program to sixfold sometime near the end of this century. Other nations which have adopted this program include Thailand, as discussed in the text, and Jordan.

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