

Human Capital Accumulation and Economic Growth in Asia

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The emerging technologically-centered economic system of the modern world calls for the acquisition and mastery of new knowledge, or for the upgrading of skills. Traditional patterns of trade – for the most part based on cost advantages - are being replaced by trade patterns based on ‘non-price’ competitiveness (quality, information-intensity...). The need for appropriate human capital development and accumulation is a prerequisite for modern economic growth in both developed and developing economies.

Placed in the broad framework of the ‘new’ growth and ‘new’ trade theories, our contribution builds on the famous hypotheses advanced by Easterlin (1981) and others, which is that the population’s formal level of schooling governs largely the acquisition and application of new knowledge and the prospects for economic development. We will analyze the developmental experiences of ten Asian countries: the ASEM-10 (minus Brunei)¹ and India. The aim is to provide some understanding in relation to the impact of knowledge on economic growth in the selected countries since the early 1980s, via the improvement of their human capital stock.

The first section assesses the salient points in the debate on the technology/ human capital – economic growth relationship. Section 2 presents the variables selected as well as the data, and it will discuss the main findings. Finally, a few conclusive avenues will be proffered.

1. Salient points in the debate on the human capital - economic growth relationship

1.1. Evolution of the position of the ‘human capital’ and education concepts in economic thinking

Human capital is normally understood to refer to the skills and knowledge intensity of the labor force in an economy, which are essentially acquired through schooling and training. The relevance of human capital accumulation to the process of economic development stems from its potential beneficial impact on macroeconomic productivity and on the long-run distribution of incomes, once some basic conditions are met. Moreover, sociologists highlight the fact that education is often associated with the loosening of traditional and religious norms. The sequence therefore is: schooling → modernity → economic growth.

In the Economics literature, the concepts of human capital and education did not however receive constant attention throughout the years. The 1960s and early 1970s were marked, in the western world mostly, by an enthusiasm for the issue of education and its presumed positive impact on economic growth. The pioneer in the field, Schultz (1960: 571), talks about the “moral issue of treating education as an investment in man”, and he suggests to treat its consequences as a form of capital. The notion of ‘human capital’ appears. Although this approach may be seen as filling a void in traditional (i.e. neo-classical) economic analysis

where the skills attributes of the labor force were overlooked, it also led to an *ad nauseam* tendency of ‘capitalizing’ any aspect of humankind’s life². This enthusiasm for education led to various attempts at measuring both human capital and the rate of return on investment in education. The expenditure on education becomes treated as an investment rather than as consumption. Many contributions at the time were centered on the issue of the rate of return to schooling (see Eckaus, 1964; Becker, 1967; and Johnson, 1970 in particular). Whereas Eckaus (1964) criticizes the use of the rate of return criteria, Johnson (1970) develops a model that will predict life-time earnings based on several types of investments in human capital. Beyond the many attempts to measure the costs and benefits of education, Schultz (1960: 571) formulates the following hypothesis: “some important increases in national income are a consequence of additions to the stock of this form of capital”. The formation of this “kind of capital” is probably responsible for the “unexplained” increases in national income (the famous ‘residual’ in the work of Fabricant and Solow). The issue of schooling and its impact on long-term economic growth, started to dominate social science discourse in the 1960s and [early] 1970s. This line of thinking is for example explored by Denison (1964)³. The dominant hypothesis is that education affects positively economic growth since it increases the level of cognitive skills possessed by the labor force and consequently its marginal productivity.

However, the 1970s were marked by a much smaller general enthusiasm about the beneficial impact of education. As unemployment among school graduates became widespread in a context of quasi-generalized economic recession, caution and skepticism about the beneficial economic impact of education became the norm (Benavot, 1989)⁴. At the time, the dominant discourse in Europe was centered around the notion of ‘technology lag’, as R&D policy and innovativeness in some key sectors (electronics) were seen as the sources of comparative advantage in industrialized economies.

Eventually, the debate among economists shifted during the 1980s to the impact of technology, combined with knowledge and skills, on economic growth. Perhaps, partly as a response to the criticisms voiced by development economists, in particular by the Marxist Dependency School, and partly as a desire to catch-up with the thinking in other disciplines (such as history and sociology), it became obvious that technical change could not be seen independently from human interaction, therefore from human capital. Technology could not be seen separately from the human inputs who create them or who utilize them. Although the idea of inseparability between technology, - and particularly technology diffusion-, and human inputs had already been expressed in the economics literature in the 1960s and 1970s (Cipolla, 1965; Rosenberg, 1970; Mansfield, 1975), it was only in the mid-1980s that the issue became seriously taken up by most

¹ The nine ASEM countries considered here are therefore Indonesia, Malaysia, Thailand, the Philippines, Singapore, Vietnam, China, South Korea and Japan.

² For a very healthy criticism of this ‘capitalization’ tendency, see Fine (2001).

³ For a review of such studies, see Psacharopoulos and Woodhall (1985).

⁴ During that decade, the discourse on economic development in developing countries was dominated by the Marxist Dependency School which emphasized the issue of inward FDI in Ldcs, the problem of inappropriate technology, etc.

economists. This culminated, in the second half of the 1980s, with the so-called ‘new growth theories’, which can be seen as the formalization of rather ‘old’ ideas.

1.2. Education and Economic Growth

Using an historical approach, Easterlin formulates in 1981 an interesting hypothesis. His study purports to explain under-development in some countries of the world by the late arrival of mass primary education, which delayed the process of technology transfer. Basing his study on a small number of western and developing countries, he claims that the reason why economic growth has spread so slowly among the nations of the world is because of a limited geographical diffusion of technology. This limitation is in turn linked to both the quantity and *quality* of the educational systems. Since technology transfer is intimately linked to the educational process, Easterlin therefore sees schooling as a crucial variable. The spread of technology depends on learning potentials linked to formal schooling⁵. The emphasis on quality should not be dismissed. Indeed, the problem of curricula insufficiently adapted to national requirements or, in the limit case, of totally inappropriate curricula explains, according to Mehmet (1999: 137) why “the human capital revolution had little impact on educational theory and policy in developing countries”, with the exception of the four Asian tigers.

A first test to Easterlin’s hypothesis was provided by Hanson (1989). In his study of 37 ex-colonies of the most developed European countries in 1960, Hanson (1989) finds first that schooling in these countries was determined primarily by socio-cultural and political factors. By regressing several indicators of economic development, of technology, and of income on the adult literacy rate, he then goes on to show that all coefficients for the literacy rate (corresponding to the several regression equations) are statistically significant. In particular, increases in the literacy rate have a statistically significant (and positive) impact on income, and on the reduction of the agricultural share in national product. Sociologists have obviously largely contributed to the debate. For example, Benavot (1989) applies a panel regression methodology to 93 developed and developing countries to investigate the long-term effects of enrolment rates at primary and secondary levels (1960-1985). His results provide “evidence that primary education substantially contributed to the expansion of national economies in the post-War II period”, but with important gender differences (Benavot, 1989: 28). Interestingly, “in less developed countries, educational expansion among school-age girls at primary level has a stronger effect on long-term economic prosperity than does educational expansion among school age boys”. Educating girls is a foundation of the next generation of human capital; it reduces poverty and contributes directly to sustainable economic growth (ADB, 2000; Schultz, 2002).

⁵ This idea is emphasized later in the work of Abramowitz (1986) and of Cohen and Levinthal (1990) who highlight the importance of a nation’s ‘social capability’ and ‘absorptive capacity’ respectively.

In his literature review of the education-growth relationship, Psacharopoulos (1993) claims that, in general, the rates of return to education are higher for primary education, than for further education, and that primary education contributes more to economic growth in LDCs (less developed countries) than in DCs (developed countries). A substantial primary schooling system is essential for sustained economic growth, in the first stages of economic development. The way widespread basic literacy affects positively economic development in LDCs is multifold. Basic schooling (up to the age of 14) is sufficient to absorb simple technologies, and leads to macro-economic productivity gains⁶. Mass formal schooling preceded economic growth in western countries such as the USA and Germany, whereas the case of generalized basic education is often cited as the key explanatory element of the four East-Asian tigers' fast growth experience in modern times (Chowdhury and Islam, 1993; Sen, 1997). Adult literacy rates, taken as the most visible result of widespread schooling at primary level, were all above 50 per cent in 1960, and above 85 per cent in the mid 1980s in South Korea, Taiwan, Hong Kong and Singapore. These economies had substantially high literacy rates and high levels of primary education before they embarked upon their export-led growth economic recovery.

On the other hand, studies relating to the impact of tertiary education on economic growth provide mixed results⁷. This plurality of conclusions is explained by a variety of factors, among which: the fact that different studies rely on different variables (enrolment rates as opposed to literacy rates of the working population⁸; the non uniformity in the definitions of educational levels across countries; finally, the linear form of the models used, concealing thereby the effect of structural breaks and of critical values. Graff (2001) tries to bring some explanations for this "higher education puzzle". One is the law of diminishing returns, according to which the marginal contribution of education to productivity growth decreases with the accumulation of human capital stocks. This leads to the view that the major beneficial impact of computerization, of digitalisation, and of the corresponding tertiary education, on productivity and growth, are over in the developed countries (Gordon, 2000).

In order to understand the extent to which the use of different educational attainment indicators may lead to consistent, or alternatively, to different and contradictory analyses and results, Lall (2001: 149) analyzes the correlation of three particular indicators with per capita income, using data on 120 countries. He finds that tertiary technical enrolment, the HM measure for the year 1995, and the B-L measure are all highly correlated with incomes⁹. Nevertheless, what these findings may suggest, at least in the case of tertiary

⁶ However, simpler technologies generate a smaller potential for further productivity increases and command smaller spillover effects than more complex technologies.

⁷ In a recent empirical study, Graff (2001) provides a stimulating discussion on this issue. For example, Wolff and Gittleman (1993) obtain a significantly positive coefficient for tertiary education in the case of DCs, whereas a similar conclusion is reached by Graff (1995) albeit for LDCs only. Graff tries to bring some explanations for this "higher education puzzle".

⁸ With the notorious problem which is that enrolment rates conceal differences in completion rates. In their field investigation carried out in 1994 in government primary schools of 16 villages of Uttar Pradesh, Drèze and Gazdar (1997) found an attendance rate of generally 50 per cent below the official enrolment rate.

⁹ Tertiary technical enrolment is defined as tertiary total enrolment (times 1000) plus tertiary enrolment in technical subjects (times 5000), both as a % of the population. The Harbison and Myers Index (HMI) is based on secondary school enrolments plus tertiary

enrolment and of the HM measure, is that wealthier countries have a greater financial ability to invest in human capital at the higher levels of education than poorer countries. The study of the human capital accumulation – economic development relationship is indeed fraught with the cause and effect confusion. The positive impact of economic growth on education explains the development of tertiary education in developed countries where a much larger amount of public funding is required.

In spite of the many shortcomings when measuring exactly educational attainment (as a proxy of human capital accumulation) and when studying the human capital-growth relationship, two major conclusions can be drawn from the various studies undertaken on this issue:

- (i) educational attainment indicators are highly correlated with the wealth levels of countries; in particular, mass primary education has a positive impact on growth.
- (ii) different levels of education have different impacts on growth, depending on the stage of economic development reached by the various countries, and also on the *quality* of education.

2. Specification of the variables, data and results

A first straightforward way to measure the significance of human capital accumulation on growth is to use GDP or GNP figures as the dependent variable. However, given that most of the countries under analysis here are developing economies, a better tool would be to combine measures of real national or domestic incomes with variables “that we ultimately value” (Sen, 1994: 364), such as life expectancy, the quality of health, etc (Crafts, 1997). Unfortunately, the lack of consistent comparable data over the years has compelled us to discard the use of any Human Development Indicators. We will therefore regress standard measures of economic development on measures of human capital, controlling for the other variables found in an aggregate production function. Starting with an early form of the production function $Y = AK^\alpha L^{1-\alpha}$, we can expand it to include other variables by writing:

$$Y = f(K, L, HK) \quad (\text{Eq. 1})$$

Where Y , K , L , and HK refer to GDP, capital, labor and human capital respectively. With regard to the study of the catching up process in the case of developing economies, through export led growth and industrialization-by-invitation, it makes sense to decompose K into domestic capital (DK) and foreign capital (FK), that is the capital imported through foreign direct investment (FDI). Domestic (and indigenous) capital is represented by gross domestic investment as a percentage of GDP. Foreign capital refers to inward FDI stock as a percentage of GDP. In light of the discussion above, human capital is proxied by a composite indicator encompassing an output indicator (literacy rates) and an input indicator

enrolments (as a % of the relevant age group) multiplied by five. The Barro and Lee (B-L) Index is based on the total years of schooling at various levels.

(i.e. gross enrolment ratios at secondary level). Table 1 summarizes the source and nature of the variables used.

Table 1. Specification of the variables used in the empirical test

Variable	Definition	Expected sign
Y	GDP of country i <i>Source: World Development Report and World Development Indicators, Various Issues (World Bank: Washington)</i>	
L	Labor force in country i <i>Source: same as above</i>	(+)
DK	Gross domestic investment as a percentage of GDP <i>Source: same as above</i>	(+)
FK	Inward FDI stock as a percentage of GDP <i>Source: World Development Report</i>	(+)
HK	Literacy rate and gross enrolment ratio at secondary level <i>Source: World Development Indicators and UNESCO</i>	(+)

By taking the logarithm of the two sides of equation 1 above and by differentiating them, we obtain the following function:

$$\ln y = \alpha + \beta \ln L + \gamma \ln DK + \delta \ln FK + \zeta \ln HK \quad (Eq.2)$$

where β , γ , δ , and ζ represent the elasticity of production relative to labor, domestic capital, foreign capital and human capital. Due to data limitations, we use a panel data analysis for the following years: 1980, 1990 and 1997. Although more recent data would tend to be of a better quality, these have been excluded because of their limited consistency with data relating to previous years, given the existence of a structural break represented by the 1997 Asian crisis. It should be noted that a confusion still persists with regard to the reciprocal impact of educational attainment indicators and economic conditions. Economic growth also causes educational growth, although the historical evidence brought by Easterlin (1981) suggests that in the USA and Germany for example, widespread formal schooling *preceded* the onset of modern economic growth¹⁰. It seems that a substantial schooling system is a prerequisite for sustained economic growth.

¹⁰ That economic growth causes educational growth can explain the development of tertiary education (where a much larger amount of public funding is required).

Finally, as has been hinted at above, the quality of human capital in any country commands the ability of inward investment (foreign capital) to add to economic growth. Indeed, a poor educational system leads to a weak absorptive capacity, which in turn prevents inward investment from producing positive trickle down effects in a recipient economy. On the other hand, high literacy rates and high enrolment ratios at all levels, reduce costs for investors and therefore attract technology-embodied capital from developed countries (absorptive capacity hypothesis).

Table 2. The GDP/human capital relationship

Variables	
Intercept	0.25 (0.06)
$\ln L$	0.70 (5.84)***
$\ln DK$	1.85 (2.28)**
$\ln FK$	0.05 (0.91)
$\ln HK$	1.30 (3.08)***
R square	0.65
R-adjusted	0.60
F	11.86 (1,53E-05)
Years	1980, 1990, 1997
Observations	30

With all these caveats in mind, an empirical test on our log linear statistical model was performed, the results of which are presented in table 2.

All explanatory variables have coefficients with a positive sign, implying a positive contribution of labor, physical capital, and of human capital to the expansion of economic wealth. The selected explanatory

variables provide most of the explanation for the change in GDP ($R^2 = 0.65$)¹¹, and the P-value for the F-statistic (1,53E-05) indicates significance of the overall model at the one percent level.

The coefficient δ for foreign capital (*FK*), although positive, is not statistically significant, implying that it could be omitted from the model. In pure economic terms, it should be noted that because of its size, and in spite of the gradual liberalization of its economy since the 1970s, Japan has been the major recipient of FDI over the period (30 per cent). Yet the *FK/GDP* ratio, although increasing over the years, was only 0.7 per cent in 1997, implying that FDI exercised only a marginal contribution on Japanese GDP. For the other variables, the marginal effect of their variation on GDP is strongly statistically significant. In particular, the domestic capital elasticity of production is the highest at 1.86. This mirrors the dynamism of the domestic (and indigenous) productive fabric in the 10 Asian countries analyzed. Interestingly, one percentage change in human capital produces an impact nearly twice as large on GDP (1.3 per cent) than one percentage change in labor (0.7 per cent). Although both variables are significant at the 1 per cent level, what seems to have mattered most, even for the poorest countries in the sample, i.e. Vietnam and China, is the quality of the labor force, as opposed to the quantity of same. Both China and Vietnam inherited a relatively good educational system from the communist parties' widespread literacy drive, aimed at eradicating illiteracy among the masses, primarily in the countryside. India stands out as the country where literacy, gross enrolment ratios at primary level, and completion rates are the lowest of all countries reviewed. With the exception of the state of Kerala, which boasts the highest achievements in terms of a number of social indicators including infant mortality, life expectancy, and literacy¹², most of India needs to come to grips with its cultural and societal features that hinder mass schooling (Ramachandran, 1997).

Conclusions

For all economies of the world, acquiring and sustaining competitiveness implies investing in education so as to accumulate an adequate stock of human capital. By viewing schooling as an investment in man, the economists of the 1960s have opened a new avenue in the analysis of the determinants of wealth. Subsequent work done in the 1980s has enlarged the discussion on the returns to schooling by replacing the analysis at the macroeconomic level. In particular, using a historical approach, Easterlin (1981) explains under- development in some countries of the world by the delayed arrival of mass schooling at primary level. Studies made in the ambit of the new growth theories have complemented this picture by treating technology and human capital as two inseparable elements in the process of economic growth creation.

¹¹ Using the logarithms of domestic and foreign capital data (as opposed to their respective share in GDP) produces a R-square of 0.98. However, taking the shares of these variables in GDP lessens the well-known problem of built-in correlation once noted by Michaely (1977) in the case of GDP and exports.

¹² In 1991, more than 90 per cent of Kerala's population was classified as literate.

Borrowing from these various strands of analyses, our contribution aims at explaining the impact of human capital on the economic growth of 10 Asian economies over the 1980-1997 period. Going beyond the many definitional limitations of most studies, we define human capital on the basis of a composite indicator encompassing literacy rates and enrolment ratios at secondary level. This definition encompasses both an input and an output indicator, thereby improving on previous studies. Using a panel regression methodology, we find that human capital has a significant and positive impact on GDP, confirming the results of earlier studies. The study shows the superiority of the quality of human capital in explaining GDP growth, when compared with the quantity of labor. What seems to have mattered most for all 10 Asian countries since 1980, is the addition to knowledge as opposed to the simple increase of labor units in their economies. These results also translate the increasing importance of the intensity of intellectual capital to the economies under review, and in particular to the most advanced ones, such as Japan, South Korea and Singapore. However, educational attainments in the poorest countries should not be dismissed. In particular, China and Vietnam are two countries that have inherited very sound educational systems from the past. For these countries, the challenge is to preserve this advantage in the light of their economic opening.

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