Economics Bulletin

Volume 29, Issue 3

Education and economic growth: the role of public expenditures allocation

Mohamed Ben Mimoun
Université de Paris 1 Panthéon Sorbonne, Paris

Asma Raies
Université de Paris 1 Panthéon Sorbonne, Paris

Abstract

We show in this paper that GDP per-capita growth is more likely affected by the accumulation of education at the higher schooling levels in both OECD and DCs. However, in terms of the public funds allocation, this result does not prevent public education expenditures to be reallocated from higher toward basic schooling levels in DCs. Indeed, such a reallocation would improve the quality of education at the basic stages of education, which should be, in turn, accompanied by a faster accumulation of human capital at the higher schooling stages and faster economic growth.

Citation: Mohamed Ben Mimoun and Asma Raies, (2009) "Education and economic growth: the role of public expenditures allocation ", *Economics Bulletin*, Vol. 29 no.3 pp. 2404-2416.
Submitted: Jul 22 2009. **Published:** September 23, 2009.

1. Introduction

This paper aims to empirically study the role of human capital and public education expenditures in economic growth. The study of such a role is a major subject of interest in both the augmented Solow neo-classical approach that emerged after the work of Mankiw, Romer and Weil (1992), and the endogenous growth theories developed with the premonitory works of Lucas (1988) and Romer (1990). Frequently, the 'human capital-growth' regressions tend to use aggregate indicators of human capital, with mean education of the population as the most-used indicator. These aggregated measures, however, do not provide the education policy-maker information with regard to the efficient allocation of education expenditures across the various schooling levels. For this reason, looking at the growth effects of education at the different educational stages would overcome this insufficiency.

Studies that aim to estimate the growth impact of human capital accumulated at the various stages of education are scarce. The study of Gemmell (1996) is one notable contribution to this literature. It uses cross-section data to estimate the economic growth impact of both stocks and accumulation rates of education at the various schooling levels (primary, secondary, and tertiary). The author's main conclusion is that human capital effects on growth are most evident at the primary and secondary levels in lower- and higher-income developing countries, respectively, but are more evident at the tertiary level in the case of developed countries.

This result, however, should be taken with some cautions, as i) the author does not provide any direct comparison of the effects of different flows and stocks across developed and developing countries; ii) the growth effects of both the stock and the accumulation of education at the secondary level are found to be negative in the case of developed countries, which is a result difficult to interpret, and iii) this study does not explain how primary human capital stock and accumulation may foster income growth; namely, in the case of developing countries. Thereby, this work still raises some other issues. Is investment in tertiary education not rewarded in the developing countries? Economic growth in the developed countries is more affected by investments in the tertiary education; does this imply that governments in these countries should allocate fewer resources to the basic school levels?

Beyond these unanswered questions, previous empirical works do not explicitly estimate the magnitude of the impact of public expenditures at the successive schooling levels, which is a crucial issue from a governments' point of view in the context of education provisions. Our study aims to fill the gaps discussed above by proceeding in two steps. We first estimate the growth impacts of human capital in its disaggregated form, and compare these impacts between developing countries (DCs) and OECD countries. We then estimate the growth effects of public education expenditures at the different stages of education for these two groups.

We find -contrary to Gemmell (1996)- that the accumulation and initial stocks of secondary and tertiary education have positive effects on economic growth in both groups of countries, with the higher marginal impacts in DCs. This evidence suggests a close association between human capital produced at the higher levels of education and technological progress, which is a source of growth. Human capital accumulated at the

primary schooling level, however, is only a prerequisite for attending advanced education levels but does not, in itself, promote growth.

In addition, our estimation results point out clearly *decreasing* marginal returns of the per-student public expenditures, with respect to the schooling level in DCs. This indicates that education public funds are misallocated in DCs, which supports, *ceteris paribus,* a reallocation policy of public resources in favour of the lower stages of education. By improving the quality of education at these levels, this policy should contribute to raising the participation rate at the higher stages of education in the DCs, and thereby to fostering their economic growth.

These conclusions are confirmed once proxies for inequality in the distribution of expenditures across the educational stages, and of initial human capital stocks are included in the growth equation. Indeed, we find that economic growth decreases as inequality in the allocation of public education funds rises, and as initial distribution of human capital stocks is being more unequal.

The remainder of this paper is structured as follows. Section 2 presents cross-section estimates of the effects of human-capital in its disaggregated form on economic growth. In section 3, the flows of per-student expenditures are used as regressors in the 'growth equation' instead of the rates of human-capital accumulation. We show that DCs should allocate differently their expenditures across educational levels. In section 4, we tackle the multicollinearity issue that arises with the disaggregated forms of educational expenditures and human capital stocks. Finally, section 5 concludes the study.

2. Human capital accumulation and growth

We aim here to identify the effects of human capital in its disaggregated form on growth, which is an issue that previous studies in this research area have not sufficiently treated. As far as one considers average educational attainment of the population as a proxy of human capital, one may disaggregate this stock by considering the distribution of the population across the educational levels, as illustrated in the Barro and Lee's (2000) database. We thus obtain the stock of primary, secondary, and higher- education, defined by the fractions of individuals that have attained the primary, the secondary, and the higher-education stages, respectively. Analysing the contribution of education in its disaggregated form to economic growth is an interesting task, because different types of human capital are expected to have different effects on growth and across the groups of countries. In what follows, we estimate the impacts of both the accumulation rate of the three forms of human capital and their corresponding initial stocks, on the growth of per-capita income. In the right-hand side of Equation (I) below, the initial stock and the accumulation rate of human capital are expressed in their disaggregated form.

$$GR(y) = a_0 + a_1 \, Log(y)_{60} + a_2 \, Log\,(S_k) + \sum_i a_{3i} \, Log(H_i)_{60} + \sum_i a_{4i} \, GR\,(H_i) \quad \text{(I)}$$

where $GR(y)$ is the growth rate of per-capita GDP at constant prices (over 1960- 2000) available in the Penn World Table (version 6.1); y_{60} is real GDP per-capita in 1960 at constant prices from the PWT (6.1); S_k is the ratio of capital investment over GDP (average, 1960-2000) from the PWT (6.1); $(H_i)_{60}$ and $GR(H_i)$ are respectively the initial stock and average growth rate of human capital of type i, where $i =$ (Primary, Secondary, and Higher-education levels); and "*Log*" indicates the log form.

Because of the high correlation [1] across the initial human-capital stocks (H_P, H_S, H_H), they are included separately in the growth equation as shown in Table 1. One can point out two major results from these estimations.

1: The coefficients of correlation across these stocks are: r $(Log\ (H_P)_{60}, Log\ (H_S)_{60}) = 0.59$, *r* $(Log\ (H_P)_{60}, Log\ (H_H)_{60}) = 0.51$, *and r* $(Log\ (H_S)_{60}, Log\ (H_H)_{60}) = 0.76$.

Table 1: Growth regression results with disaggregated human capital

Dependent variable: *Growth of GDP per-capita ((%), average 1960-2000)*

	Full sample			*Developing Countries*			*OECD*		
Variables	*Eq (1a)*	*Eq (2a)*	*Eq (3a)*	*Eq (1b)*	*Eq (2b)*	*Eq (3b)*	*Eq (1c)*	*Eq (2c)*	*Eq (3c)*
Constant	3.65	2.29	1.00	8.11	3.48	1.94	11.16	8.45	7.35
	(1.83)	(1.71)	(0.58)	(2.96)	(1.74)	(0.73)	(5.42)	(4.73)	(4.40)
Log (S_k)	2.02	1.99	2.12	1.57	1.86	2.03	1.80	1.74	1.98
	(6.27)	(6.68)	(5.99)	(2.37)	(5.41)	(4.74)	(1.95)	(1.95)	(1.99)
Log $(y)_{60}$	- 0.94	- 1.08	- 0.75	- 1.05	- 1.25	- 0.88	- 2.24	- 2.23	- 2.04
	(- 3.94)	(- 4.44)	(- 2.84)	(- 1.85)	(- 3.59)	(- 2.20)	(-7.11)	(- 8.48)	(- 6.80)
HC. Accumulation									
$GR(H_P)$ (%)	- 0.005	----	----	- 0.005	----	----	- 0.005	----	----
	(- 0.80)			(- 0.57)			(- 1.26)		
$GR(H_S)$ (%)	----	0.013	----	----	0.014	----	----	0.012	----
		(1.98)			(1.96)			(2.02)	
$GR(H_H)$ (%)	----	----	0.018	----	----	0.019	----	----	0.015
			(1.96)			(2.03)			(1.95)
HC .Stocks									
Log $(H_P)_{60}$	0.21	----	----	0.26	----	----	0.13	----	----
	(0.56)			(0.52)			(0.63)		
Log $(H_S)_{60}$	----	0.73	----	----	0.83	----	----	0.68	----
		(3.97)			(3.86)			(2.81)	
Log $(H_H)_{60}$	----	----	0.36	----	----	0.38	----	----	0.32
			(1.85)			(1.92)			(178)
N.obs	88	90	88	67	69	67	21	21	21
$\overline{R}^2$	0.421	0.523	0.450	0.393	0.514	0.419	0.856	0.816	0.799
B-Pagan $\chi^2(.)$	0.59	0.82	1.9	0.10	0.03	0.57	8.34	2.70	4.45
$\Pr > \chi^2$	0.40	0.36	0.2	0.65	0.85	0.44	0.00 [e]	0.10	0.03 [e]
Hausman F (*)	4.77	0.28	1.68	6.42	0.36	1.66	0.90	0.42	1.17
$\Pr > F$	0.03 [f]	0.59	0.2	0.01 [f]	0.54	0.20	0.35	0.52	0.29

Notes: *t-statistics are in brackets. e: Homoscedasticity hypothesis is rejected, and estimations are run using White's procedure.*

f: *the Hausman test rejects the exogeneity hypothesis, and estimations in this case are run using 2SLS technique.*

(*): we use Log (y_{60})*,, the percentage of urban population in 1960, and Log* $(H)_{60}$ *as instruments for respectively* $GR(H_P)$, $GR(H_S)$ *and* $GR(H_H)$.

The first result concerns the effects of *initial human-capital stocks*. As can be seen from Table 1, the form of initial human-capital (hereafter, HC) stock that affects income growth differs across sub-samples, with secondary and higher initial HC stocks more relevant in DCs than in OECD countries. The growth effect of the primary initial HC stock, however, comes out positive, but statistically insignificant in both OECD and DCs.

This result is crucial because it identifies the sources of growth among the different forms of HC stocks. Unambiguously, primary HC is excluded from the enhancing growth factors. That is, initially accumulated secondary and tertiary HC stocks only, can contribute to fostering economic growth. By facilitating adoption or creation of new technologies, these forms of HC are considered as engines of technological progress in both groups of countries, and are, thereby, sources of economic growth. Nevertheless, although primary education has no direct effect on growth, it is essential for the growth process, as it is a prerequisite for acquiring advanced educational levels.

The second important fact -shown in Table 1- concerns the impacts of *the growth rates* of the various types of human capital on the growth rate of per-capita income. The estimation results show that these impacts are *increasing* with the educational stage. The effect of primary HC accumulation is, however, insignificantly negative. This tendency toward increasing marginal returns of human capital accumulation is also evident in both sub-samples of countries. This result confirms the idea that technological progress and, thus, economic growth are driven by HC accumulated at the higher educational levels, which are associated with know-how and creativity. Furthermore, as for the effects of the initial stocks of HC, the estimation results show that the growth impacts of the accumulation rates of human capital are higher in the case of DCs than in OECD countries.

These results are novel as they clearly identify which type of HC accumulation can foster more rapidly economic growth. It follows that the more rapid the accumulation rates of HC at the higher stages of education, the faster is the economic growth rate. Policy implication of such a result is obvious. Both OECD and DCs should foster the accumulation rates of human capital at the secondary and tertiary educational levels. This may be ensured by fostering enrolments at these schooling levels, which unambiguously involves the allocation policy of public funds across the successive stages of education.

3. Public education expenditures and growth

Internationally comparable data on public[2] expenditures by educational stage are not available. Our study remedies this deficiency by constructing data on annual per-student public education expenditures at the primary, secondary, and tertiary levels, expressed in PPP (Purchasing Power Parity) terms.

2: Only public educational founds are included here because we aim to identify policy guidance in terms of the allocation of public educational budget and because cross-country data on private finance -as tuition fees at the higher education- is inexistent. Nevertheless, the absence of private finance in the growth equation is not problematic as public and private finance can be seen as perfect substitutes and one can in this case deduce the growth impacts of the private finance from the ones associated with public finance.

The growth impacts of the different forms of educational expenditures are estimated using the model (I) above, with the only difference consisting of including the 'flows' of per-student expenditures as explanatory variables in the growth equation, rather than the accumulation rates of the various forms of human capital. Hence, the estimated coefficients upon the expenditure variables can be interpreted as representing the 'marginal returns' of public investment in education. These returns would show how public expenditures should evolve, given the actual allocations. The equation we estimate is the following:

$$GR(y) = a_0 + a_1 Log(y)_{70} + a_2 Log(S_k) + \sum a_{3i} Log(H_i)_{70} + \sum a_{4i} Log(Exp_i) \quad \text{(II)}$$

where: $(H_i)_{70}$ and Exp_i are respectively the initial stock of human capital of type i and the average per-student public expenditures at the i^{th} school level, where i = (primary, secondary, and higher). Because data on expenditures and enrolments are only available from 1970 in the UNESCO database, average expenditures are computed on the period 1970–2000, initial income and initial human-capital stocks are those observed in 1970, and average per-capita income growth rate is calculated on the period 1970–2000. Expenditures are here included separately in the growth equation because of problems of multicollinearity that arises when they are included together in the same regression. Estimation results are reported in Table 2, below.

The results in Table 2 corroborate the conclusions emerging from Table 1 with regard to the growth impacts of initial human capital stocks, namely, i) initial secondary and tertiary HC stocks have supremacy over the one of the primary HC, and ii) the marginal effects of these stocks are higher in DCs than in OECD countries. The most important result shown in Table 2 has to do with the impacts of public expenditures on economic growth. The estimated coefficients upon the expenditure variables are positive in the three samples of countries, but significantly different from zero in the full sample and the DCs sample only.

This result provides support that educational expenditures have a role to play in fostering economic growth, namely in the DCs. Also, the estimation results show *decreasing* marginal impact of the expenditures with respect to the schooling level when we consider these two samples of countries. This suggests that educational expenditures are misallocated, especially in the DCs. Indeed, the differences in the effects of educational expenditures in DCs are so high that they suggest high-growth benefits as a result of increasing resources in favour of the lower-schooling levels in these countries.

One should notice that this result does not contrast with the one established in the previous section along which, the elasticity of per-capita income with respect to human capital is *increasing* in the schooling level. That is, the accumulation of human capital at the higher-educational levels in DCs is only possible through generalizing primary education, which in turn, requires increased resources toward this schooling level. In itself, human capital accumulated at the primary level does not benefit growth. But, because this education is a prerequisite for accumulating advanced human capital, the higher the coverage of this level, the more rapid is the accumulation rate at the higher stages of education, and the faster is economic growth.

Table 2: *Growth regression results with disaggregated public education expenditures*

Dependent variable*: Growth of GDP per capita ((%), average 1970-2000)*

	Full sample			*Developing Countries*			*OECD*		
Variables	*Eq (1a)*	*Eq (2a)*	*Eq (3a)*	*Eq (1b)*	*Eq (2b)*	*Eq (3b)*	*Eq (1c)*	*Eq (2c)*	*Eq (3c)*
Constant	3.00	5.63	3.28	3.40	5.14	4.31	8.11	8.55	6.14
	(2.03)	(2.43)	(1.67)	(1.49)	(3.03)	(1.48)	(4.28)	(4.73)	(3.25)
Log (S_k)	1.44	1.38	1.97	1.22	1.78	1.92	1.95	1.91	1.97
	(3.25)	(2.57)	(5.18)	(2.27)	(4.96)	(4.19)	(1.97)	(1.96)	(2.00)
$Log\,(y)_{70}$	- 1.53	- 3.53	- 1.18	- 1.77	- 1.94	- 1.37	- 2.11	- 3.10	- 3.31
	(- 4.18)	(- 3.40)	(- 3.29)	(- 3.47)	(- 5.18)	(- 2.77)	(- 3.26)	(- 3.99)	(- 4.29)
P-stud.expenditures									
$Log\,(Exp(_{Prim}))$	0.96	----	----	1.36	----	----	0.28	----	----
	(3.18)			(2.99)			(1.15)		
$Log\,(Exp(_{Sec}))$	----	0.62	----	----	0.64	----	----	0.44	----
		(2.51)			(2.09)			(1.04)	
$Log\,(Exp(_{High}))$	----	----	0.36	----	----	0.32	----	----	0.42
			(0.93)			(1.26)			(1.08)
HC .Stocks									
$Log\,(H_P)_{70}$	0.21	----	----	0.22	----	----	0.06	----	----
	(1.08)			(0.96)			(0.15)		
$Log\,(H_S)_{70}$	----	1.05	----	----	0.85	----	----	0.35	----
		(3.35)			(3.95)			(1.79)	
$Log\,(H_H)_{70}$	----	----	0.48	----	----	0.52	----	----	0.31
			(2.58)			(2.37)			(1.86)
N.obs	86	86	86	67	67	67	19	19	19
$\overline{R}^2$	0.394	0.419	0.352	0.369	0.422	0.361	0.434	0.511	0.638
B-Pagan $\chi^2(.)$	0.98	0.78	0.00	0.03	0.58	0.01	1.36	0.00	0.63
$Pr > \chi^2$	0.32	0.37	0.97	0.85	0.44	0.94	0.24	0.97	0.42
Hausman F (*)	1.99	6.02	1.05	1.82	3.54	0.60	1.05	0.03	0.43
$Pr > F$	0.08	0.01[f]	0.30	0.18	0.07	0.44	0.32	0.86	0.52

Notes**:** *- t-statistics are in brackets. (*) We use Log* $(y)_{70}$ *and enrolment ratios in 1970 as instruments of the corresponding expenditure variables. f: the Hausman test rejects the exogeneity hypothesis, and estimations in this case are run using 2SLS regression.*

4. Overcoming the multicollinearity

In this paragraph, we show that our results are robust to including other variables that capture the growth impacts associated with the distributions of initial HC and expenditures across the schooling levels. These variables consist of the Gini index of education in 1970, noted by *GiniEdu_70*, and the Gini index associated with the distribution of public expenditures across primary, secondary, and tertiary schooling levels, noted by *Gini _T* . More details on the computation of these indexes are provided in the Appendix. Table 3, below, illustrates the growth impacts of inequality in the initial distribution of HC and of inequality in the allocation of public funds in the three considered samples of countries. The ratios of total expenditures to GDP, noted by τ , are included in the regressions in order to control for the cross-country differences in education budgets. We also introduce regional dummies to control for the specific regional-effects.

The estimation results provide supplement evidence that public education expenditures are, on average, misallocated. This is especially more evident in the sample of DCs. These countries would gain much in term of economic growth rate if they allocate more equally their public funds across the educational stages. This result confirms the conjecture we pointed out in the previous section, namely, that the growth impacts of educational expenditures are decreasing with the level of schooling in the DCs.

Table 3 also shows that economic growth in the three samples of countries decreases as the degree of initial educational inequality rises. This is more salient in DCs than in OCDE countries. This result corroborates the conclusion established in the previous section along which, initial secondary and tertiary HC stocks have supremacy over the one of the primary HC in fostering economic growth; and the marginal effects of these stocks are higher in DCs than in OECD countries. This result also confirms the empirical findings of Lopez, Thomas, and Wang (2001); Thomas, Wang, and Fan (2000); and Castello and Domenech (2002) with regard to the detrimental impact of educational inequality on economic growth.

Finally, one can notice that the ratio of expenditures over GDP, τ , has a positive, but, insignificant effect on the growth rate of per-capita income in both the full and the DCs samples. However, this effect comes out statistically significant at 10% in the case of the OECD countries, which seems to indicate that for educational budgets to have significant impact on economic growth rates, the allocation of these budgets across the schooling levels have not to be biased against the lower levels.

Table 3: *Growth regression results with Gini indexes for public education expenditures*

Dependent variable*: Growth of GDP per capita ((%), average 1970-2000)*

Variables	***Full sample***	***Developing Countries***	***OECD***
Constant	0.800 (0.20)	0.225 (0.03)	11.97 (2.72)
Log (S_k)	1.991 (2.19)	2.253 (1.92)	1.476 (1.90)
Log $(y)_{70}$	- 1.986 (- 3.33)	- 1.893 (- 2.56)	- 2.476 (- 2.63)
τ (%)	0.020 (0.10)	0.331 (0.62)	0.195 (1.62)
Gini_T (%)	- 2.426 (- 1.97)	- 3.918 (- 2.19)	0.333 (0.05)
GiniEdu_70 (%)	- 1.096 (- 1.99)	- 2.496 (- 2.31)	- 1.255 (- 1.87)
Sub-Sahara. Afr	- 1.170 (- 1.87)	- 1.071 (- 1.48)	----
Latin America	- 1.074 (- 2.26)	- 1.022 (- 1.52)	----
East Asia	0.741 (1.28)	1.372 (1.62)	----
N.countries	86	67	19
R^2	0.461	0.513	0.675
B-Pagan $\chi^2(.)$	0.01	0.10	3.35
$Pr > \chi^2$	0.941 [a]	0.757 [a]	0.553 [a]
Hausman F	2.51	1.47	3.00
$Pr > F$	0.121 [b]	0.24 [b]	0.113 [b]

Note: t-statistics are in brackets.

a: Homoscedasticity hypothesis is accepted, and estimations are run using OLS technique.

b: For the Hausman test, we use the ratio of total educational expenditures over GDP(τ) in 1970, as instrument for this average ratio. In all the specifications, this test accepts the exogeneity of τ, and the estimations are run using OLS technique.

- GiniEduc_70 and Gini_T are respectively the Gini index of the distribution of education in 1970, and the Gini index of public expenditures across the primary, the secondary, and the tertiary levels over the period 1970-2000.

5. Conclusion

Our study identifies the contribution to growth of human capital accumulated at the successive educational levels. We find that whereas the initial stocks and accumulation of human capital at the secondary and the tertiary education have significant positive effects on per-capita income growth in both the OECD and DCs,

those associated with the primary school level exert insignificant effects in these two samples of countries.

In light of this result, we have asked how public expenditures should be allocated across the educational levels. By using in the 'growth equation' the flows of per-student public expenditures at the different school levels, the estimations results point out *decreasing marginal returns* associated with public expenditures, with respect to the educational level in DCs, which suggests additional resources to be allocated in favour of the lower-schooling stages in this group of countries. Indeed, despite that primary human capital does not -in itself- benefit growth, more resources should be allocated in favour of this schooling level in the DCs, simply because it is a prerequisite for attaining higher educational levels. Additional resources devoted to the primary level should aim to generalise education at this schooling level among the population and improve its quality, which in turn, should be associated with more investment in higher levels of education and faster growth. Unlike the DCs, economic growth rates in the OECD countries seem to benefit from two factors associated with education: low inequality in the initial distribution of education (i.e., advanced human capital stocks were high); and high levels of equality in the allocation of public expenditures across the schooling levels which translate into higher accumulation rates in advanced stages of education.

Appendix 1: Computation of the Gini indexes of expenditures:

The Gini index of the distribution of expenditures across primary and secondary schooling levels, *Gini_S*, is computed as follows:

$$Gini\_S = \frac{1}{D}\left(l_p\, l_s \left|D_p - D_s\right|\right)$$

where, D is total education expenditures; D_p and D_s are expenditures devoted respectively to the primary and the secondary levels; l_p and l_s are the proportions of enrolled students at the primary and the secondary levels, respectively.

The Gini index of the distribution of expenditures across primary, secondary, and tertiary schooling levels, *Gini_T*, is computed as follows:

$$Gini\_T = \frac{1}{D}\left(l_p\, l_s \left|D_p - D_s\right| + l_p\, l_t \left|D_p - D_t\right| + l_s\, l_t \left|D_s - D_t\right|\right)$$

where l_t and D_t are respectively the proportion of students enrolled in the tertiary education, and education expenditures at this educational level, respectively.

Appendix 2: *Summary descriptive statistics: 1960-2000.*

	Full sample					*Developing Countries*					*OECD*				
	Obs	*Mean*	*S.D*	*Min*	*Max*	*Obs*	*Mean*	*S.D*	*Min*	*Max*	*Obs*	*Mean*	*S.D*	*Min*	*Max*
y_{60}	107	789	736	111	3414	85	491	319	111	1733	22	2007	707	778	3414
S_k	107	15.5	7.84	2.19	45.5	85	13.8	6.97	2.19	45.5	22	26.0	3.62	19.1	33.0
$GR(y)$	107	2.05	2.15	-6.94	8.06	85	1.91	2.28	-6.94	8.06	22	2.86	0.78	1.58	4.58
Initial human capital stocks (% of Labour force aged more than 25 years) (1960)															
H_{60}	86	3.4	2.5	0.1	9.5	64	2.5	1.8	0.1	7.6	22	6.65	1.94	1.94	9.56
$(H_P)_{60}$	88	41.1	25.1	0.3	90.3	67	36.2	24.4	0.3	69.3	21	59.9	17.9	31.4	90.3
$(H_S)_{60}$	90	11.6	12.8	0.2	61	69	7.5	7.04	0.2	27.9	21	27.6	17.6	3.5	61
$(H_H)_{60}$	88	2.3	3.3	0.1	20	67	1.5	1.74	0.1	9.9	21	5.85	5.60	1.1	20
Human capital growth (in %) (1960-2000)															
$GR(H)$	105	12.3	9.8	0.37	51.4	83	14.0	10.0	0.37	51.4	22	5.05	2.82	1.43	12.3
$GR(H_P)$	95	3.6	14.7	-20.8	68.0	73	6.30	15.0	-12.4	68.0	22	-7.74	5.41	-20.8	1.98
$GR(H_S)$	95	18.7	18.7	-9.41	154.7	73	21.2	19.4	-7.37	154.7	22	8.61	10.6	-9.41	29.4
$GR(H_H)$	95	28.4	19.8	-4.19	156.3	73	29.6	21.3	-4.19	156.3	22	23.6	10.4	3.58	42.4
Education expenditures (Average 1970-2000)															
$Exp(prim)$	86	930	1293	5	7590	67	460	586	5	3640	19	2971	1542	395	7590
Exp(sec)	86	1403	1187	17	8160	67	759	676	17	5800	19	3040	1086	664	8160
$Exp(high)$	86	3703	2531	146	19220	67	2212	2455	146	11565	19	6453	1997	1750	19220
Gini_T (%)	86	39.8	11.8	8.83	78.5	67	43.9	14.9	8.96	78.5	19	28.6	6.56	8.83	42.0

References

Alan Heston, Robert Summers and Bettina Aten, *Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.*

Barro, R.J and Lee, J.W. (2000) "International Data on Educational Attainment: Updates and Implications" *NBER WP N° 7911*.

Castello, A and Domenech, R. (2002) "Human Cpital Inequality and Economic Growth: Some New Evidence" *The Economic Journal, 112: 187-200*.

Gemmell, N. (1996) "Evaluating The Impacts of Human Capital Stocks and Accumulation on Economic Growth: some New Evidence" *Oxford Bulletin of Economics and statistics, 58(1), 9-28.*

Lopez, R., Thomas, V and Wang, Y. (2001) "Addressing The Education Puzzle: The Distribution of Education and Economic reforms", *World Bank Policy research WP 2031*.

Lucas, R.E (1988) "On The Mechanics of Economic Development", *Journal of Monetary Economics 22: 3-22.*

Mankiw, N.G., Romer, D and Weil, D. N (1992) "A Contribution to The Empirics of Economic Growth" *Quarterly Journal of Economics, 107: 407-37*.

Romer, P. (1990) "Endogenous Technological Change" *Journal of Political Economy, 89(5): 71-102*

Thomas, V.Y., Wang and Fan, X., (2000) "Measuring Education Inequality: Gini Coefficients of Education" *mimeo. The World Bank.*

UNESCO, databases on school enrolments and public education expenditures (2003).