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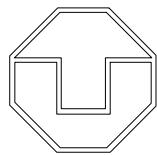
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TECHNISCHE UNIVERSITÄT DRESDEN

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Educational Imbalance, Socio-Economic Inequality, Political Freedom and Economic Development

by

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Michael Graff

*This paper describes tests of several hypotheses put forward in the literature on the significance of education as a determinant of economic development. It is shown that the generally positive impact of education on economic development is severely impaired by ‘educational imbalance’ in the case of tertiary education, whereas economic inequality and repression of political rights primarily seem to reduce the social returns of the lower educational levels.*¹

Overview

The paper is organised as follows: The introduction reviews some of the main theoretical arguments from various disciplines of the social sciences about the relation between education and economic development and summarises the main empirical regularities established so far.

Section II presents the empirical results of this study. While the underlying econometric model follows the standard ‘new’ growth literature procedure of regression analysis in a cross-section of countries, it goes beyond the existing studies in drawing on a data set including proxies for technical progress and educational attainment as well as devoting special attention to different levels of education, ‘educational imbalance’, socio-economic inequality, political freedom, and possible structural changes.

Education as a whole is shown to be growth promoting for all levels of economic development. However, characteristic structural breaks are identified for different levels of educational attainment and economic development.

Most important, the impact of tertiary education on economic development in less developed countries is shown to depend on a country’s educational policy: tertiary education does promote growth, if – and only if – there are no serious ‘educational imbalances’. Consequently, countries which invest heavily in higher education while neglecting more basic educational levels may gain little or no social returns. Other – more basic – dimensions of socio-economic and political deprivation (as measured by the Gini-coefficient or Gastil’s political freedom index) do not seem to have the same negative influence on the social benefits from higher education. Inequality and political repression, however, significantly reduce the marginal contributions of the lower educational levels to economic growth and development.

The variables, the data and their sources are documented in the appendix (III).

¹ The present analysis is an extension and elaboration of research first published in German (Graff, 1996). Drawing on new data (the latest revised version of the Penn World Tables) to compile the basic economic variables, the ‘higher education’ results from Graff (1996) are strongly confirmed. Moreover, the operationalisation of ‘educational imbalance’ has been improved by constructing an index variable with clearly defined bounds rather than a ratio of two variables, as in the earlier paper. The inclusion of measures for socio-economic and political freedom and the resulting empirical inferences are entirely new work. The author is indebted to Frank Leibbrand for critical remarks and helpful comments on an earlier version.

I Introduction

Traditional economic growth theory seeks to identify equilibrium growth paths. Its approach is explicitly ahistoric, and the well-known result is that in the long run the secular growth rate of per capita income depends on exogenous technical change only. Specifically, it is impossible to alter the secular growth rate by variations of the saving rate (Solow, 1956). This result has led to a general disappointment with neo-classical growth models; if technical change falls like ‘manna from heaven’, and no other variables have any perpetual influence on the per capita growth rate, nothing can be done to improve a country’s growth performance. This, of course, apart from being simplistic, is in no way an acceptable result. Growth rates *do* differ across time and space, and there are good reasons to believe that much of the difference is due to economic and social forces that cannot be considered as given by nature.

During the last decade, economists have taken up the task of endogenising some of the most obvious driving forces of economic growth into the general setting of the neo-classical system (Clerc, 1995). Leaving formal details aside, *new* (or *endogenous*) growth models generate endogenous growth by introducing some factor of production that does not underlie the ‘law of diminishing returns’, and making the rate of change of this factor depend on the flow of resources devoted to its creation. There remains, however, an uncomfortable gap between theoretical necessity and empirical evidence; in other words, economists need to have a sensible idea of what the new factor of production might look like.

Since it is generally accepted that in the long run (and the *very long run* is what neo-classical growth models are concerned with) all accumulation of physical capital must eventually run into diminishing returns, the ‘new’ factor of production has to belong to some sort of ‘intangible’, *knowledge-related* capital, and it is here that education enters the stage. Hence, starting with the seminal article of Lucas (1988), education has been one of the two main candidates to generate endogenous growth (the other being technical knowledge). Without ignoring the formal sophistication needed to demonstrate that neo-classical growth models which neither necessarily implode or explode can indeed be formulated, the economic intuition is quite simple and can be stated thus: Economies with a better educated labour force can make better use of the material factors of production as well as of the relevant technical knowledge. If ‘education’ as a factor of production can be accumulated without running into diminishing returns and physical capital cannot, the resulting policy advice is to shift resources from capital goods production to education.

The traditional tool for economists to deal with education has been *human capital theory*. Hence, some new growth theorists labelled their growth-generating factor of production ‘human capital’ (though this is a matter of taste rather than a conclusive theoretical implication – labels like ‘R&D’, ‘blueprints’, etc. are also widely used).

The basic idea – i.e. considering education as an investment in future skills (i.e. ‘human capital’), rather than merely a consumption good – can be traced back to the classics. In the 1950s it was stated in a formal manner by Becker, Schultz, Mincer and others (cf. Bowman, 1966) and initiated a huge wave of empirical research. Psacharopoulos (1993), who has been a close observer of this line of research for decades, summarises its main results as follows:

1. Private as well as social rates of return to education are highest for primary education. The probable explication is that though at the primary level expenditure per pupil is lowest, the cognitive and motivational effects of instruction are highest, provided school attendance is continuous.

2. Rates of return to schooling are higher in poorer than in richer countries. The usual explication is that the ‘law of diminishing returns’ applies to education. (Note that this somehow contradicts the new growth theorist’s identification of education with the factor which may generate growth forever.)
3. Private rates of return are higher than their social counterparts, and this more so for higher levels of education. The reason lies in the fact that accounting for public expenses for education adds more to the costs than taxes and other additional forms of revenue add to national income. Note that the spread between private and social rates of return to tertiary education is especially large in LDCs.
4. Rates of return to general education are higher than to vocational and other highly specialised education. This ‘vocational school fallacy’ (Foster, 1966) has disappointed the high hopes of development planners in the 1950s and 60s. It is now obvious that vocational schools are economically inefficient; generally, the cost of ‘vocationalisation’ by far exceed any measurable social benefits. (Note that in many instances, there are simply no jobs which require the specific skills taught in vocational schools.)

Critics of rate-of-return-to-education-computations argue, however, that the results may be far from accurate; and the published numbers should indeed not be considered more than approximations to the true values. Certainly, too many confounding variables are causing biases which are hard – if not impossible – to quantify and the published numbers should indeed not be considered to be more than crude approximations to the true values (cf. among others Behrman/Wolfe, 1976; Klees, 1991).

A more serious attack on human capital theory states that its theoretical foundations are unsound. According to these critics, the underlying assumption that education raises productivity is just taken as given; if it is discussed at all, the proof is claimed to be in the domain of sciences others than economics, but usually economists refer to ‘intuition’.

Hence, for lack of deeper insights, economists usually model human capital accumulation as a linear function of time devoted to education, a specification which may be misleading, since there could be various effects of education at different ages, different levels of education and other ‘structural breaks’ (Helberger, 1988).

Thus, the crucial questions are *how* education changes individuals and *what effects* it has on the aggregate level.

An answer from *social psychology* is that education promotes individual ‘modernity’, the chain of causation is stated as education → individual modernity → income. Empirical evidence is given by Inkeles/Smith (1974), who demonstrate that ‘years of schooling’ is the best predictor for individual modernity on their ‘OM’(Overall Modernity)-personality scale, provided schooling has been regular and continuous for at least some three to four years (cf. also Coulclough, 1982). Their conclusion is that the school is the major modernising institution and that the education-modernity link depends most of all on the *socialising* function of regular school attendance at primary educational levels.

Despite their instrumental definition of modernity (cf. Mumatz, 1988), Inkeles/Smith have added to our knowledge that the education-modernity link depends most of all on the *socialising* function of regular school attendance at primary educational levels.

Sociologists state that education promotes the rationality of social organisation in various ways. First, the shift from traditional to meritocratic principles should increase macroeconomic efficiency

(Behrendt, 1965). Second, the loosening of traditional and religious norms, which is frequently associated with education, may initiate a ‘social mobilisation’ of innovative activity (Deutsch, 1961), and scholars of *economic history* claim that this is exactly why modernisation and industrialisation occurred two centuries ago in today’s DCs (Rosenberg/Birdzell 1986: 34). In contrast, Weber’s famous hypothesis is that the strict ‘ethics of Protestantism’ – asceticism and thrift – are a driving force in capitalist development (Weber, 1905); thus attributing high importance to the prevalence of religious norms instead of their relaxation. More recent contributions, however, cast doubt on the significance of religious norms for economic behaviour (Wuthnow 1994: 622). Moreover, valuable as they may be for the interpretation of economic history, sociological macro-theories are very hard to handle in a quantitative fashion.

While the contributions discussed so far try to fill the explanatory gap left open by human capital theory, others deny that it is a useful concept at all. First of all, the *signalling/screening*-hypotheses refer to the selective function of educational systems and claim that differences of individual income may have little or nothing to do with productivity differentials caused by education. Instead, economic positions (and incomes) are allocated to according to the applicant’s formal level of education (Bhagwati/Srinivasan, 1977; Spence, 1973). According to this view, formal education promotes ‘credentialism’ and does not add anything to macroeconomic efficiency (though it perfectly explains private rates of return to education).

While pure educational credentialism is unlikely to be very common, it might prevail in certain labour markets, especially where diplomas of distinguished grammar schools, colleges or universities serve as entry tickets into the local elite. The more the signalling function of diplomas reveals some characteristics relevant to economic productivity, however, the more it is likely to increase macroeconomic efficiency. It is thus reasonable to assign some relevance to human capital theory and the *signalling/screening*-hypotheses as well; though for different explanatory ranges (Robinson/Browne, 1994: 594). While human capital theory and modernisation hypotheses rely on increased productivity by socialisation or acquisition of skills which are provided by the primary and perhaps the secondary levels of the educational system, educational credentialism might be the rule for the tertiary level.

In this context, a lively controversy is concerned with the educational policy of LDCs. While it is generally acknowledged that the LDCs have managed to increase educational levels at an astonishing rate (Patel, 1986), critics argue that too many poor countries spend too much on tertiary education (e.g. Blaug, 1979; Justman/Teubal, 1991). In this view, ‘educational imbalance’, i.e. fostering higher education while neglecting more basic educational levels, often create nothing but highly specialised ‘academic proletarians’ without hope of ever being able to use their skills; or – even worse – strong incentives for the highly skilled to migrate abroad: the so-called ‘brain drain’ (Blomqvist, 1986).

In addition, this controversy has to do with economic and political power. Specifically, according to Mokyr (1990), economic history shows that an educated elite which is generally keeping away from economic, technical, and other practical matters, has been a major obstacle to technological progress and economic growth (e.g. the classical Greek and Roman civilisations, China after 1500 BC, and the Latin American offshoots of Iberian origin). And when nowadays some of the poorest countries afford a sophisticated system of higher education which has little or nothing to do with the real problems of backward countries (Pritchett, 1995), while illiteracy and poverty continue to be the fate of the majority of the population, it may indeed not be a far-fetched assumption that these educational systems serve mainly to perpetuate social and economic inequality and thereby the privileges of the ruling elite: educational credentialism at its worst.

In less extreme cases, however, the potential dynamics of economic developments may suggest other conclusions. The rise to economic and political power of a well-educated, highly motivated and innovative new elite plays a decisive role in various theories of economic development (BarTEL/Lichtenberg, 1987; Easterlin, 1991; Eisenstadt, 1973; Machlup, 1970; Schultz, 1988), and it is considered a precondition for the Rostowian ‘take off into sustained growth’ (Rostow, 1960). Moreover, education figures prominently among other possible determinants of a country’s capacity to absorb technology from abroad (Dowrick/Gemmell, 1991) like R&D (Cohen/Levinthal, 1986), and in this context it is plausible to assume that the *higher* levels of education are more important than more basic ones.

To summarise, the present theoretical knowledge about the role of education in economic development is highly fragmented and inconclusive. To gain more understanding of the ‘true’ relationships and to rule out ‘false’ hypotheses it is therefore advisable to turn to *empirical* research.

For empirical investigations, the standard procedure in the ‘new growth’ literature is to refer to an ‘augmented’ aggregate production function

$$Y = A K^\alpha L^\beta H^\gamma T^\varphi,$$

where Y is GDP, A a constant, K physical capital, L labour, H human capital, and T a proxy for the state of technical knowledge. Assuming constant returns to scale in K , L and H ($\alpha + \beta + \gamma = 1$),² i.e. the production inputs traded on factor markets, dividing by L , and taking logarithms and time derivatives yields

$$g(Y/L) = g_A + \alpha g(K/L) + \gamma g(H/L) + \varphi g_T,$$

where g_X stands for the continuous growth rate of a variable X . As much of the recent discussion is concerned with ‘convergence’, in addition to the right-hand variables derived above, there usually is a ‘convergence’ variable like the log of per capita income at the beginning of the time period studied (Y/L), and a vector Z of proxy-variables for possible determinants of a country’s capacity to absorb technology from abroad as well as a number of socio-political and institutional variables (Barro, 1991).³ The typical estimation equation is thus

$$g(Y/L) = a_0 + a_1 g(K/L) + a_2 g(H/L) + a_3 g_T + a_4 \ln(Y/L) + \sum a_i Z_i.$$

From the studies conducted so far, several general conclusions emerge (Levine/Zervos, 1993; Sala-I-Martin, 1994). First, physical capital accumulation is by far the most important determinant of economic growth. Second, controlling for physical capital accumulation and educational variables, countries with initially lower per capita incomes are indeed catching-up (*conditional convergence*). Third – and of most importance for the present paper —, controlling for physical capital accumulation and initial per capita income, countries with higher scores for educational variables tend to grow faster.

However, there are serious difficulties to come to a coherent interpretation of the various – and in many instances contradictory – regression coefficients of the wide range of educational variables

² Cf. Graff (1995) for a series of empirical tests in a comparable research design, showing that the null hypothesis of constant returns to scale to K , L and H may be maintained at all conventional significance levels.

³ Adding level-variables as regressors for the growth rate of per-worker income rates somewhat alienates the estimation equation from the production function framework, the parameters, therefore, must not be interpreted as exact production elasticities. In addition, while the growth rates are stationary, the level-variables Y/L and H/L are not, which may cause further biases (Pritchett 1995). As in most of the ‘new growth’ empirics, attention, therefore, will be given primarily to the estimated signs rather than to minor differences in parameter magnitudes.

used by different researchers; and especially the empirical evidence on the benefits of tertiary education is far from clear: Some studies suggest that poor countries may expect high returns to investments in the tertiary level of education, while others indicate no social benefits, or even adverse effects.

To a certain degree, this may probably be explained by the use of indicators that are notoriously unreliable (e.g. enrolment rates and literacy rates). Worse, perhaps, is that frequently researchers choose indicators of dubious validity (e.g. enrolment rates for educational *stocks*, educational attainment of *urban* workers in largely *rural* societies, or years of schooling in the labour force *excluding all persons under twenty five*, i.e. ist possibly *most dynamic part*). Moreover, the ‘model’ of educational effects – if it may thus be called – is generally *linear*, assuming homogenous human capital. Consequently, possibilities of structural breaks, critical values, diminishing or increasing returns to education, and contingencies of certain types of education on other variables cannot be dealt with.

Exceptions from this simplistic model are Bowman/Anderson (1976), who show that literacy rates must exceed some forty per cent before they show any correlation with economic growth. Others have demonstrated that the same applies to ‘years of schooling’ which likewise show no correlation – simple or partial – unless they exceed three to four years (Azhar, 1988; Graff, 1995; Lau/Jamison/Shu-Cheng/Rivkin, 1993). Some studies test for structural breaks (Benavot, 1989; Timmermann/Graff, 1995; Wolff/Gittleman, 1993). These studies consistently confirm that primary education contributes more to economic growth in LDCs than in DCs, thereby giving some evidence for the modernisation-hypothesis. The results for tertiary education, however, are again contradictory: While Benavot (1989) finds a significantly *negative* influence of tertiary enrolment on the growth rate of per capita income, Wolff/Gittleman (1993) get a significantly *positive* regression coefficient, although *only for the DCs*. Timmermann/Graff (1995) compute a principal component variable for higher educational levels which yields a *positive* coefficient for *all income levels*, and in Graff (1995) ‘years of schooling’ of persons with tertiary education is significantly *positive* only *in the LDCs*.

Hence, there is not only a *theoretical*, but also an *empirical* ‘higher education puzzle’, and much research remains to be done. The following analysis tries to give some tentative answers.

II. Education and economic growth: a new empirical analysis

The empirical analysis to be presented follows the usual ‘new growth literature’ cross-country regression method outlined above.⁴

The sample consists of all seventy-four countries (comprising LDCs as well as DCs), for which the required variables were available, and covers the period from 1960–92.

The left-hand variable is the 1960–92 growth rate of per capita income in ‘international \$’ ($g(Y/L)$). While the focus is on human capital resulting from education H/L , the set of variables which has in other studies consistently been shown to contribute to economic growth: the growth of capital intensity $g(Y/L)$, the ‘convergence’ variable $\ln(Y/L)$, and – now widely accepted (cf.

⁴ In the last time, this procedure has been criticised as naively empiricist (cf. Harberger 1998: 21, among others). Specifically, the ever-present endogeneity bias prohibits to interpret the estimated parameters as anything close to ‘growth elasticities’ from which researchers may draw reliable conclusions for future growth behaviour. Accordingly, the following estimations should not be taken to be more than heuristic explorations into some ‘stylised facts’ of modern economic growth and development.

Otani/Villanueva, 1990) – a proxy for openness to trade Z , is taken into account. In addition, we compute a rarely used variable, a proxy for technical progress g_T . H/L , $g(Y/L)$, $\ln(Y/L)$, Z and g_T are then simultaneously included on the right-hand side as control variables, thereby reducing the ever-present omitted variable bias. Consequently, the basic estimation equation is

$$g(Y/L) = a_0 + a_1 \ln(H/L) + a_2 g(K/L) + a_3 g_T + a_4 \ln(Y/L) + a_5 Z.$$

If not stated otherwise, the primary data are from the ‘Penn World Tables, Mark 5.6.’ (Summers/Heston, 1988, revised version, University of Toronto, December 1997). The sampling procedure, the operationalisation and computation of the variables are described in the appendix. Two remarks, however, are in order:

First, economists have recently become aware of the serious problems underlying international statistics on educational data supplied by organisations as UNESCO, UNDP and the World Bank (Behrman/Rosenzweig, 1994). While these data are readily available for use in cross-country/time-series analysis, little attention has usually been given to the scarcity of the underlying observations (most of the printed data are actually no more than extra- or interpolations, or even worse: mere ‘guesstimates’). Moreover, the informational content of widely used data such as adult literacy rates or the mean years of schooling of the population over twenty five is doubtful for the econometrics of economic growth, since it may be a poor proxy for educational attainment of the economically active population. In addition, the latest available data-bases on educational attainment (Barro/Lee, 1996; Nehru/Swanson/Dubey, 1995) unfortunately suffer from the fact that schooling is grouped by the traditional levels (primary, secondary and tertiary, which vary considerably across countries), rather than by grades, thereby ignoring some important information on the *structure* of the educational stock. The present paper tries to avoid some of the usual problems by using *all available information* on educational attainment from population census publications. Census data on *educational attainment* have several advantages: They are neither biased by the prestige of literacy, nor are they representing flows, as are enrolment rates. To capture most of the economically important education-related skills, contrary to the praxis of using data for the population over twenty five, this study refers to the *labour force*. Available census data and secondary sources allow the computation or estimation of the *mean years of schooling in the labour force* for the seventy-four countries of our sample in 1975 (*MYS*), and a further desegregation into three subgroups of educational attainment corresponding to the first six grades, the seventh to eleventh grades, and the higher levels of education (*LOW*, *MED*, and *HIG*).⁵

Second, the inclusion of ‘technical progress’ – more than all other variables used in the present study virtually ‘unmeasurable’ – is motivated by the special interest in ‘higher education’ which is likely to be correlated and/or to interact with ‘technical progress’ (Grossman/Helpman, 1994: 29). Since no single variable from published statistics is likely to give an unbiased estimate of technical progress, the procedure followed here is to consider a wide array of information from international statistics on R&D, patenting activity, scientific publications, and direct acquisition of technical knowledge from abroad, and then to take the first *principle component* of these variables as a proxy for g_T .

⁵ It would have been desirable to include *growth rates* for the schooling variables (i.e. proxies for $g(H/L)$) as well; due to the scarcity of census data, however, this would restrict the sample to less than thirty countries which is insufficient for statistical inference. Thus, $g(H/L)$ was dropped as a right-hand variable.

Results

The first step of the present analysis is to conduct four OLS-regressions of $g_{(Y/L)}$ on the set of its potential determinants considered in this study according to the basic equation derived above, where H/L is represented by *MYS*, *LOW*, *MED* and *HIG* respectively. The results are given in *table 1*.

TABLE 1: Basic Regressions

| Estimation | 1 | 2 | 3 | 4 |
|------------------------------------|---------------------|--------------------|---------------------|---------------------|
| Intercept | 4.79*** (3.39) | 4.19*** (2.72) | 4.51*** (3.14) | 5.67*** (3.60) |
| $\ln MYS \cdot 10^{-3}$ | 7.23*** (2.97) | | | |
| $\ln LOW \cdot 10^{-3}$ | | 1.23 (.71) | | |
| $\ln MED \cdot 10^{-3}$ | | | 3.26** (2.34) | |
| $\ln HIG \cdot 10^{-3}$ | | | | 3.80*** (2.50) |
| $g(K/L)$ | .52*** (13.51) | .53*** (12.42) | .55*** (14.18) | .50*** (12.20) |
| $g_T \cdot 10^{-3}$ | 3.87*** (2.38) | 5.26*** (3.02) | 4.13*** (2.50) | 3.74* (2.30) |
| $\ln(Y/L) \cdot 10^{-3}$ | -7.01*** (-3.57) | -4.88** (-2.46) | -5.59*** (-2.99) | -6.49*** (-3.29) |
| $Z(\text{Openness}) \cdot 10^{-4}$ | 8.08** (3.24) | 8.91*** (3.38) | 7.50*** (2.89) | 9.61*** (3.77) |
| R^2 | .84 | .83 | .84 | .84 |

t-statistics in brackets, n = 74, one-tailed significance: *** p ≤ .01, ** p ≤ .05 * p ≤ .1.

As shown in *table 1*, the estimated coefficients – with the notable exception of *LOW* – are significantly different from zero with their expected signs. Compared to other estimations in the ‘new growth’ literature, the model fares very well (all R²s exceed .8) and confirms the importance of physical capital accumulation and openness for economic growth as well as strengthening the evidence for ‘conditional convergence’, though according to the present estimates convergence is proceeding very – and for the LDCs: painfully – slow.⁶

⁶ Following Mankiw/Romer/Weil (1992), the ‘convergence rates’ that can be computed from the coefficients for $\ln(Y/L)$ are .0063, .0045, .0055, and .0065. Taken at face value, these convergence rates imply that for a typical country, it would take 111, 153, 135 or 118 years (depending on the specification of the educational human capital

The coefficients for educational human capital reveal the following pattern: *MYS*, *MED* and *HIG* contribute significantly to economic growth, whereas the coefficient of *LOW* is not significantly different from zero. The human capital accumulated during the years of schooling of members of the labour force with no more than 6 years of schooling, so might be followed, does not add to labour productivity.

Before accepting such far-reaching conclusions, however, the next step should be to control for possible *structural breaks*. To this end, the sample is split in two subsamples by educational attainment: thirty-seven countries with less and thirty-seven countries with more than the median value of *MYS*. Then a regression with the general human capital variable *MYS* for *H/L* is run across the two subsamples to test for the stability all regression coefficients, including the intercept, but excluding *H/L*. The usual F-Test with five and sixty-three degrees of freedom results in an empirical F-statistic of 1.10, whereas the critical value ($p \leq .1$) is 1.94, so for the five freed parameters taken together – and holding *H/L* constant – there is not even a moderately significant structural break between the two subgroups with different educational attainment. The same test is then conducted with *LOW*, *MED* and *HIG* for *H/L*, likewise giving insignificant F-statistics (.63, .50 and .65, respectively) Therefore, in the regressions that follow, the slopes for the control variables and the intercept are always computed for the whole sample, while the coefficients of the different variables for *H/L* are allowed to vary across the subgroups. *Table 2* gives the resulting human capital coefficients for the two subgroups and the corresponding F-statistics for significance of structural breaks.

TABLE 2: Regressions for subgroups by educational attainment (*MYS*)

| | low <i>MYS</i> (n = 37) | high <i>MYS</i> (n = 37) | F-Test for structural break |
|-------------------------|----------------------------|-----------------------------|--------------------------------|
| $\ln MYS \cdot 10^{-3}$ | 7.91*** | 7.14*** | .25 |
| $\ln LOW \cdot 10^{-3}$ | 0.32 | 1.72 | .26 |
| $\ln MED \cdot 10^{-3}$ | 3.77** | 2.32 | .38 |
| $\ln HIG \cdot 10^{-3}$ | 6.75*** | 9.42 | 5.72** |

One-tailed significance for coefficients,
two-tailed significance for structural breaks (df = 1, 67),
*** p ≤ .01, ** p ≤ .05, * p ≤ .1.

Table 2 shows that though the estimated coefficients for *MYS*, *MED* and *LOW* vary across the two subgroups, the differences are far from significant.

variable), i.e. some five to eight generations, to only halve the difference between its actual and ‘secular’ growth rates. Therefore, convergence, be it ‘unconditional’ or ‘conditional’, is of course nothing for the LDCs to count upon for a fast remedy against their present poverty and misery.

Moreover, as in *table 1* for all seventy-four countries taken together, the coefficients for *LOW* are in no case significantly correlated with growth – not even, as might be expected, in the educationally more backward subgroup of countries. A possible interpretation could refer to the ‘law of diminishing returns’. There might already be so much of human capital at lower levels – even in LDCs – that the marginal contribution escapes conventional significance levels.

Another possible explanation relies on similar facts, but is purely statistical: If educational attainment is about to surpass the level measured by *LOW* in all countries, i.e. also in LDCs, there is little or no variance across countries. Consequently, all countries might benefit greatly from members of the labour force with primary education (compared to none), but exactly the fact that all (or most) countries have surpassed this level of educational attainment implies that it cannot make any difference in a cross-country comparison. Be this as it may, there are good reasons not to underrate the importance of primary education, and not too much weight should be given to its statistical insignificance in the present context.

Finally, *HIG* deserves special attention. As *table 2* shows, the coefficient for *HIG* is significantly *higher* for the subgroup of countries with less educational attainment; moreover, it is significantly positive only in this group of countries; for the more educated countries alone, it is not even significant at very moderate levels ($p \leq .1$). This finding is again compatible with human capital theory. Specifically, since higher education yields higher coefficients in the group that comprises the countries with lower educational attainment, a plain explanation is that the more advanced countries have begun to run into ‘diminishing returns’.

Therefore, inferring from the present sample and model, the thesis that poor countries spend too much on tertiary education seems to be misguiding. From our results, one might rather conclude that the richer, rather than the poorer countries, have reason to doubt the macroeconomic usefulness of their educational policy.

These conclusions, however, would stand in striking contrast not only to the results of other empirical analyses that imply *little*, *none*, or even *negative* effects of higher education on economic growth of LDCs, but also with what is known of its sometimes extremely dubious integration into practical economic uses in LDCs due to rent seeking and other – at least from a macroeconomic perspective undesirable – activities.

We therefore suggest two explanations to reconcile these contradictions: first, a *statistical*, and second, a *theoretical* with third some *tentative empirical checks*.

First, a *statistical* explanation lies in the educational variables used in this study as compared to those mostly used in previous studies: Whereas others often rely on enrolment rates, i.e. *flows*, or readily available educational *stock* variables, like educational attainment of population over twenty five, this study has undertaken the task to measure, as exactly as possible, the *educational stock represented in a country's labour force*. While the choice of variables may be negligible in DCs, it probably makes a decisive difference for the measurement of education as a factor of production in many LDCs with rapid population growth, a very young labour force and an only recent expansion of educational efforts. Under such conditions, considerable time may elapse between initial educational efforts (*flows*) and major changes of the composition of educational stocks in the labour force. Moreover, these changes will first of all affect the younger cohorts. Consequently, studies relying on educational flows may systematically underestimate the effects of education which – after all – are not likely to come soon; while others may miss the educational qualifications of a significant part of the labour force. So the different statistical estimates for the effects of ‘education’ may be due to the use of educational variables which sometimes are simply not valid, and at other times not

sufficiently reliable to capture what is to be approximated: the educational stocks in the labour force.

Alternatively, a *theoretical* explanation takes a closer look at the arguments put forward by the critics of higher education in LDCs: It is never doubted that higher education *may* be useful to economic development; what they actually claim is that in many LDCs it does not serve any of its economically useful functions; instead it has rather the characteristics of a ‘consumption good’ for the upper classes – which need not necessarily be regarded as ‘waste’, but for which, of course, there is no social necessity for subsidy either. Worse, education might indeed generate skills which, however, in some societal settings are mainly devoted to unproductive or even harmful activities like rent seeking or crime (Pritchett, 1995). At the same time educational credentialism may prevail, turning higher education into a pure screening device, serving to legitimate socio-economic inequality and deprivation of political participation (Rubinson/Browne, 1994: 594).

Higher education proper would then be neither an impediment nor an inducement to economic development. ‘Educational imbalance’, however, might indicate that scarce resources are used in the interest of the members of the elite instead of being channelled into uses with high social rates of return.⁷ In this view, ‘educational imbalance’ not only implies macroeconomic ‘opportunity costs’, but indicates the existence of an influential elite and of high inequality and, thereby, a high potential for social conflict which in turn, may indeed be harmful to economic growth.

For a test of this hypothesis, a country’s ‘educational imbalance’ (*EI*) is approximated by an index that captures the relation of resources channelled into tertiary education as compared to primary education in 1975.⁸ Specifically, the seventy-four countries are split into two new subsamples by *EI*, thirty-seven ‘low scorers’ and thirty-seven ‘high scorers’.

In addition, two other, and possibly related, variables are considered: Gastil’s ‘political rights and civil liberties’ index, which is likely to capture deprivation of political participation, and the Gini coefficient (for which data are available for sixty nine counties of our sample of seventy-four) as a proxy for economic inequality.

Accordingly, there are three variables by which to split our sample into thirty-seven educationally more vs. thirty-seven less balanced, thirty-seven politically more vs. thirty-seven less repressive and thirty-five more vs. thirty-four less egalitarian countries. Then – as before – the basic regression is repeated with an additional degree of freedom for H/L, for which the coefficient is allowed to vary between the subgroups. The results are given in *table 3*. (Note that, according to the imbalance/distortion-hypothesis outlined above, significance tests for structural breaks are one-tailed.)

⁷ Pritchett (1995) gives some evidence for the suspicion that the public sector in LDCs acts as an ‘employer of last resort’ for the well-educated labour force which may indeed result in serious misallocations of scarce resources.

⁸ For details see appendix.

TABLE 3: Regressions for Subgroups by educational imbalance, inequality, and political participation

| | low educational imbalance IE (n = 37) | high educational imbalance IE (n = 37) | F-Test for structural break |
|----------------------------------|---|--|-----------------------------------|
| ln <i>MYS</i> $\cdot 10^{-3}$ | 7.41*** | 6.94*** | .10 |
| ln <i>LOW</i> $\cdot 10^{-3}$ | 1.50 | .99 | .04 |
| ln <i>MED</i> $\cdot 10^{-3}$ | 3.69*** | 1.45 | .82 |
| ln <i>HIG</i> $\cdot 10^{-3}$ | 5.19*** | 0.01 | 3.70** |

| | low repression (n = 37) | high repression (n = 37) | F-Test for structural break |
|----------------------------------|----------------------------|-----------------------------|--------------------------------|
| ln <i>MYS</i> $\cdot 10^{-3}$ | 8.92*** | 6.72*** | 2.30* |
| ln <i>LOW</i> $\cdot 10^{-3}$ | 2.96** | -2.07 | 3.44** |
| ln <i>MED</i> $\cdot 10^{-3}$ | 3.61* | 3.14** | 0.04 |
| ln <i>HIG</i> $\cdot 10^{-3}$ | 3.37** | 4.19** | .17 |

| | low inequality (n = 35) | high inequality (n = 34) | F-Test for structural break |
|----------------------------------|----------------------------|-----------------------------|--------------------------------|
| ln <i>MYS</i> $\cdot 10^{-3}$ | 6.86*** | 4.84** | 2.57* |
| ln <i>LOW</i> $\cdot 10^{-3}$ | 0.18 | 0.96 | 0.09 |
| ln <i>MED</i> $\cdot 10^{-3}$ | 3.43** | 1.09 | 1.34 |
| ln <i>HIG</i> $\cdot 10^{-3}$ | 2.91** | 3.50** | .12 |

One-tailed significance for coefficients;
one-tailed and structural breaks (df = 1, 67),
*** p ≤ .01, ** p ≤ .05, * p ≤ .1.

Table 3 shows no significant differences for *MYS*, *LOW* and *MED* between countries that score low or high on *EI*. *HIG*, however, has a significantly higher coefficient in the low-*EI* subsample. Moreover, as predicted by the ‘educational imbalance’ version of the signalling/screening-hypotheses, *higher education* yields a coefficient close to zero in the high-*EI* subsample.

The results are, however, different for the sample split by the civil liberties/political repression variable. The F-statistics show that there is no difference between the coefficients for the higher educational levels, whereas there are significant structural breaks for *MYS* and *LOW*. Hence, a lack of political rights seems to exert the expected negative influence on educational efficiency on the basic educational levels rather than on higher education. According to these results, in countries with low repression, especially the lower levels of education seem to be more growth promoting than under more repressive regimes.

The results for the sample split by the Gini coefficient are fairly similar to the civil liberties/political repression subsampling procedure. Here, a significant structural break is detected for *MYS*, indicating that education taken as a whole yields generally higher social returns in more egalitarian countries, though this regularity is weak and far from significant for the three sub-levels of educational human capital.

These first and admittedly still tentative tests give some support to the educational imbalance/distortion-hypotheses: According to the present sample and model, a less repressive and more egalitarian system generally seems to provide a better environment for a positive contribution of education to economic growth and development. Moreover, the contribution of higher education to economic growth is indeed negligible in countries that are characterised by strong ‘educational imbalance’, whereas in countries with a more balanced educational policy, it is clearly positive.

Discussion

The results of the present study, in addition to confirming much of what has been repeatedly shown in the ‘new growth’ empirics (i.e. ‘conditional convergence’), offer some new insights into the role of education at different levels of development which – if robust – could be a useful contribution to the debate about the wisdom of giving high priority to tertiary education in LDCs. Thus, some critics of tertiary education in LDCs, although having good reasons for their complaints about ‘educational wastage’ and ‘diploma disease’ in poor countries, miss the decisive point which – according to our results – lies in the fact that it is not poverty or backwardness which makes tertiary education a waste of scarce resources; quite on the contrary: it is shown that the marginal contribution of tertiary education to productivity growth declines with the accumulation of educational stocks.

A slight reformulation of the critics’ argument, however, is bringing it in line with the facts: tertiary education is indeed not a growth inducing factor – or even harmful to growth – in countries which are characterised by strong ‘educational imbalance’. However, in countries which follow a ‘balanced’ educational policy with a base of widespread primary education, secondary and – perhaps most of all – tertiary education may be a decisive growth factor.

Moreover, socio-economic inequality (as measured by the Gini coefficient) and deprivation of political participation (as measured by Gastil’s political rights and civil liberties index) do not seem to exert the same detrimental influence on the social benefits of higher education as educational imbalance proper, though educational efforts generally – and, possibly: especially efforts aimed at the

elementary level – seem to be more promising as a growth promoting device in less repressive and more egalitarian countries.

III. Appendix: country-sample, variables, data and sources

The country sample consists of seventy-four countries (excluding countries with a population of less than one million and oil-export based economies), for which the required educational, technological and economic variables were available (cf. table below). The analysed period ranges from 1960–92.

The per capita growth rate $g_{(Y/L)}$ from 1962–92 is taken as β_1 from $\ln(Y/L)_t = \beta_0 + \beta_1 t$, using OLS. Data are RGDPCH from the Penn World Tables (Mark 5.6) and t is measured in discrete years. (The predicted value for $\ln(Y/L)_{1960}$, is our ‘convergence variable’.)

Physical capital: The average growth rate of physical capital accumulation 1960–92 $g_{(K/L)}$ is computed with estimates of aggregate capital stocks that have been obtained by the *perpetual inventory* method as specified for LDCs by Harberger (1978) and refined by Nehru/Dhareshwar (1993), using a depreciation rate of ten per cent. All underlying data are from the Penn World Tables (Mark 5.6), and growth rates are computed in the same way as for $g_{(Y/L)}$.

Educational human capital (H/L) is from census data and from secondary sources (as documented in Psacharopoulos/Arriagada, 1992), where *MYS* is *mean years of schooling in the labour force* around 1975, and *LOW*, *MED*, and *HIG* result from a desegregation of *MYS* into three subgroups of educational attainment corresponding to adults that have completed the first six grades, the seventh to eleventh grades, and the higher levels of education. The present study draws on Psacharopoulos' and Arriagada's (1992) data as well as their method, which has been used to extend their original educational database relying on various editions of the *UN Demographic Yearbook*.

Technical progress: Since no single variable from published statistics is likely to give an unbiased estimate of g_T , the procedure followed here is to use as much information from international statistics on R&D (expenditure and professionals engaged), patenting activity (domestic and international), scientific publications ('scientometric' data), and direct acquisition of technical knowledge from abroad (royalties and expenditure for foreign licences) as possible. A *principal component analysis* of six indicators of the above mentioned type yields a first component that already explains eighty five per cent of all the variables' variance. In the present study the 'factor scores' of this *principle component* serve as a proxy for 'technical progress' g_T . (For further details see Graff (1995)).

A country's openness to trade Z is proxied by the residual \hat{u} from the regression $((M+X)/Y) = \beta_1 + \beta_2 \ln Y + \hat{u}$, where Y is GDP, M is imports and X is exports, and all data are taken as 5-year averages from 1973–77 (for 1975). This procedure is motivated by the well-known dependence of the volume of international trade on the size of a country's home market. (The estimated parameter for β_2 equals $-.83$ with a highly significant t of -3.40 , i.e. the variables are indeed behaving as expected) Data are from the Penn World Tables (Mark 5.6).

Educational imbalance (EI) is proxied by $1 - ((PRIM - TER) / PRIM)$, where PRIM and TER are primary and tertiary enrolment rates for 1975, and data are from *UNESCO Statistical Yearbook*. Since – mainly due to many 'repeaters' – reported primary enrolment rates exceed 1.0 for thirty-three countries in our sample, thereby not unambiguously expressing primary schooling for a higher share of a cohort, 1.0 is taken as the upper bound.

Economic inequality (Gini) is measured by the Gini coefficients as given in Deiniger/Squire (1996). Mean values for 1960–92 have been computed using all data labelled ‘accept’ (highly reliable), referring to lower quality data only for those countries that would otherwise have to be dropped from the sample.

Political rights and civil liberties (GI) are measured by Gastil’s well-known and widely used index (mean values for 1960–89). Data are from King/Levine (1994).

TABLE: The country-sample and variable values for educational attainment, technical progress and imbalance proxies, sorted by per capita income 1995

| | MYS | LOW | MED | HIG | w _T | EI | GI | Gini |
|----------------|------|------|------|------|----------------|------|-----|------|
| Malawi | 3.13 | 1.09 | 2.00 | .02 | -.93 | .009 | 6.5 | 52 |
| Niger | .83 | .72 | .13 | .06 | -1.11 | .005 | 6.0 | 36 |
| Togo | 1.90 | .82 | .86 | .21 | -.82 | .012 | 5.9 | ... |
| Rwanda | 1.87 | 1.74 | .28 | .05 | -.87 | .005 | 5.6 | 29 |
| Central Afr. | 2.19 | 1.01 | .82 | .07 | -.75 | .005 | 6.3 | 55 |
| India | 2.18 | 1.12 | .69 | .37 | -.89 | .106 | 3.0 | 31 |
| Kenya | 2.99 | .59 | 2.31 | .10 | -.82 | .008 | 4.6 | 54 |
| Cameroon | 2.11 | 1.49 | .59 | .09 | -.80 | .015 | 5.4 | 49 |
| Haiti | 1.52 | .54 | .83 | .10 | -.62 | .011 | 3.0 | ... |
| Bangladesh | 2.37 | .72 | 1.39 | .22 | -1.31 | .036 | 4.2 | 35 |
| Pakistan | 1.89 | .69 | .88 | .30 | -1.07 | .046 | 5.0 | 32 |
| Indonesia | 4.27 | 2.60 | 1.30 | .36 | -1.11 | .028 | 5.3 | 34 |
| Ghana | 3.48 | .36 | 2.87 | .16 | -.88 | .015 | 5.0 | 35 |
| Senegal | 2.56 | 1.87 | .56 | .12 | -.49 | .050 | 4.1 | 54 |
| Zambia | 4.90 | 1.39 | 3.35 | .13 | -.46 | .022 | 5.1 | 47 |
| Nigeria | .84 | .59 | .11 | .00 | -1.24 | .015 | 3.9 | 39 |
| Egypt | 2.95 | 1.26 | 1.06 | .61 | -.58 | .180 | 4.6 | 37 |
| Sri Lanka | 6.52 | 1.59 | 4.62 | .21 | -.79 | .017 | 3.3 | 41 |
| Honduras | 3.60 | 2.25 | .98 | .36 | -.39 | .053 | 5.7 | 55 |
| Botswana | 2.70 | .74 | 1.81 | .14 | -.34 | .010 | 3.1 | 54 |
| Philippines | 6.20 | 2.15 | 2.10 | 1.92 | -.69 | .184 | 4.5 | 48 |
| Paraguay | 4.92 | 2.61 | 1.76 | .52 | -.64 | .067 | 5.4 | 42 |
| Congo | 4.48 | 1.10 | 2.91 | .33 | -.53 | .027 | 6.2 | ... |
| Thailand | 4.45 | 2.39 | 1.59 | .45 | -1.16 | .042 | 4.0 | 45 |
| Ivory Coast | 2.87 | 1.28 | 1.65 | .00 | -.77 | .020 | 5.2 | 39 |
| Tunisia | 3.52 | 1.42 | 1.05 | .96 | -.38 | .043 | 5.1 | 43 |
| Dominican Rep. | 4.26 | 1.58 | 1.76 | .54 | -.51 | .100 | 2.6 | 47 |
| El Salvador | 4.36 | 1.43 | 2.54 | .36 | -.33 | .105 | 3.7 | 48 |
| Jordan | 5.72 | 1.68 | 2.68 | 1.31 | -.33 | .162 | 5.7 | 39 |
| Algeria | 3.16 | 1.36 | 1.52 | .27 | -.83 | .034 | 6.0 | 39 |
| Guatemala | 3.12 | 1.92 | .84 | .34 | -.49 | .068 | 4.1 | 56 |
| Korea, Rep. | 5.91 | 2.13 | 2.82 | .92 | -.20 | .103 | 5.0 | 34 |
| Colombia | 4.92 | 2.08 | 2.14 | .68 | -.73 | .077 | 2.8 | 52 |
| Nicaragua | 3.33 | 1.64 | 1.07 | .21 | -.35 | .101 | 4.7 | ... |
| Ecuador | 5.51 | 2.89 | 1.77 | .84 | -.70 | .269 | 3.3 | 52 |

to be continued

TABLE: The country-sample and variable values for educational attainment, technical progress and imbalance proxies, sorted by per capita income 1995 (continued)

| | MYS | LOW | MED | HIG | WT | EI | GI | Gini |
|-------------------|-------|------|------|------|------|------|-----|------|
| Malaysia | 6.11 | 2.81 | 2.86 | .39 | -.58 | .034 | 4.0 | 50 |
| Turkey | 3.37 | 1.76 | .93 | .65 | -.74 | .093 | 3.9 | 50 |
| Jamaica | 6.13 | 4.83 | 1.85 | .00 | -.34 | .070 | 2.7 | 42 |
| Panama | 5.83 | 2.08 | 2.62 | 1.08 | -.19 | .173 | 4.7 | 52 |
| Peru | 5.79 | 2.20 | 2.33 | 1.21 | -.63 | .146 | 3.9 | 49 |
| Chile | 6.97 | 1.02 | 5.06 | .85 | -.07 | .156 | 4.7 | 51 |
| Costa Rica | 4.50 | 2.29 | 1.10 | .60 | -.19 | .177 | 1.0 | 46 |
| Syria | 4.31 | 1.94 | 1.59 | .32 | -.66 | .126 | 6.6 | ... |
| Brazil | 4.52 | 1.40 | 2.43 | .65 | -.25 | .122 | 3.5 | 57 |
| Uruguay | 7.11 | 2.61 | 2.87 | 1.58 | -.00 | .160 | 4.5 | 42 |
| Portugal | 4.19 | 2.71 | .89 | .58 | -.07 | .108 | 2.5 | 37 |
| Mexico | 4.93 | 2.26 | 1.61 | 1.02 | -.16 | .105 | 3.7 | 54 |
| Greece | 6.04 | 2.73 | 1.98 | 1.30 | .27 | .183 | 2.0 | 35 |
| Singapore | 4.84 | 1.97 | 2.20 | .62 | -.15 | .090 | 5.0 | 40 |
| Ireland | 5.95 | 1.97 | 2.83 | 1.10 | .71 | .189 | 1.2 | 36 |
| Argentina | 7.03 | 2.27 | 3.58 | 1.14 | .25 | .272 | 3.7 | 42 |
| Iran | 2.17 | .85 | .97 | .36 | -.63 | .053 | 6.9 | 43 |
| Hong Kong | 7.99 | 2.04 | 4.88 | 1.04 | -.16 | .101 | 2.0 | 42 |
| Spain | 5.58 | 3.14 | 1.32 | 1.10 | .46 | .204 | 3.1 | 26 |
| Israel | 9.43 | .52 | 5.44 | 3.42 | 1.98 | .254 | 2.4 | 33 |
| Venezuela | 5.44 | 2.40 | 2.30 | .75 | -.10 | .181 | 2.0 | 44 |
| Trinidad & Tobago | 7.02 | 1.02 | 5.62 | .37 | .04 | .051 | 2.0 | 46 |
| Japan | 8.65 | 3.32 | 3.32 | 1.97 | 2.15 | .248 | 1.0 | 35 |
| Italy | 7.20 | 2.11 | 4.27 | .72 | 1.07 | .256 | 1.6 | 35 |
| Austria | 8.15 | 1.47 | 5.78 | .81 | 1.17 | .187 | 1.0 | 29 |
| Finland | 7.63 | 2.78 | 3.57 | 1.24 | 1.34 | .272 | 2.0 | 30 |
| U.K. | 10.90 | .29 | 5.14 | 4.24 | 1.74 | .188 | 1.0 | 26 |
| Belgium | 8.13 | 2.79 | 3.74 | 1.53 | 1.48 | .227 | 1.0 | 27 |
| Norway | 9.12 | .77 | 6.44 | 1.82 | 1.37 | .221 | 1.0 | 34 |
| Netherlands | 9.55 | 1.19 | 6.18 | 2.06 | 1.91 | .258 | 1.0 | 29 |
| Germany, West | 9.58 | 1.39 | 6.36 | 1.68 | 1.93 | .246 | 1.6 | 31 |
| New Zealand | 10.62 | 1.24 | 6.03 | 3.25 | 1.01 | .259 | 1.0 | 34 |
| France | 5.57 | 2.79 | 1.76 | .98 | 1.66 | .245 | 1.8 | 42 |
| Denmark | 7.67 | 2.78 | 3.49 | 1.26 | 1.15 | .294 | 1.0 | 32 |
| Australia | 10.35 | .89 | 5.77 | 3.57 | 1.42 | .240 | 1.0 | 24 |
| Sweden | 8.25 | 1.61 | 4.56 | 2.07 | 1.86 | .288 | 1.0 | 32 |
| Canada | 10.42 | 1.59 | 5.21 | 3.58 | 1.27 | .397 | 1.0 | 31 |
| Switzerland | 9.54 | 1.87 | 5.84 | 1.79 | 2.23 | .165 | 1.0 | 34 |
| USA | 11.27 | .94 | 5.90 | 4.38 | 2.24 | .579 | 1.0 | 35 |

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